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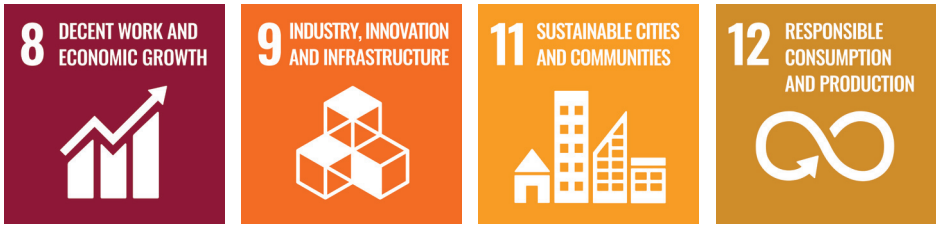

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FOREWORD

Dear researchers and colleagues,

It is with great pleasure and pride that we present to you the proceedings of the XIV Conference on Region, Entrepreneurship and Development (RED). Since its inception, the RED conference has been an important platform for bridging the gap between academic research and practical solutions to the pressing challenges facing our regions and societies. Over the years, the conference has fostered dialogue, stimulated innovation and contributed to the development of policies and practises that drive sustainable development.

This year's proceedings of the RED XIV conference include 31 papers by researchers from Austria, Bosnia and Herzegovina, Croatia, Portugal, Slovenia, Serbia, Spain and Turkey. Their joint work reflects the interdisciplinary and international spirit of the conference.

The papers address critical issues such as healthcare efficiency, regional economic disparities, the impact of macroeconomic variables on well-being, digitalisation and the rural-urban divide, and the changing landscape of local governance. Particular attention was paid to the intersection of technology and development, with research on artificial intelligence in start-ups, industry readiness for Industry 4.0 and the adoption of augmented and virtual reality.

All submitted articles have undergone a double-blind peer review process to ensure the highest scientific standards. We would like to thank our reviewers, whose expertise and commitment have contributed significantly to the quality of this publication.

At a time characterised by economic uncertainty, geopolitical instability and rapid technological change, collaboration between academia and industry is more important than ever. We are convinced that the research presented here will not only add to academic knowledge, but also provide valuable insights for policy makers, practitioners and all those involved in shaping the future of our regions.

We thank all contributors for their commitment and passion, and we look forward to the continued growth and impact of the RED conference.

With best regards,

Anamarija Delić, PhD
Chair of the Organizing committee

Sunčica Oberman Peterka, PhD
Chair of the Program Committee

RED 2025

REGION

A scientific paper

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ECONOMIC ACTIVITY IN CROATIA: INSIGHTS FROM REGIONAL LEVELS

ABSTRACT

The aim of this paper is to synthesize perspectives from various scholarly domains by examining the concept and fundamental characteristics of economic activity. Within this framework, the phenomenon of established businesses that change their principal economic activity, thereby contributing to the transformation of the economic structure, represents a significant yet underexplored area. Analyzing these transitions provides valuable insights into the complex interplay of individual, organizational, and environmental factors.
To achieve this, the paper adopts a contextualized approach, drawing on three distinct regional entrepreneurial ecosystems in Croatia (Istria, Zadar, and Vukovar-Srijem counties) which vary in their levels of socio-economic development. Descriptive statistical analyses of data obtained from the Croatian Bureau of Statistics offer insights into the trends and transitions among established businesses that have changed their principal economic activity, as defined by the National Classification of Activities 2007 - NKD 2007. In addition, a one-way analysis of variance (ANOVA) was conducted to identify temporal disparities in these transitions. Together, these methods enable an assessment of the extent to which such changes align with regional development goals.
The findings reveal regional disparities in sectoral transitions and emphasize the influence of region-specific development strategies, firm-level attributes, and institutional support on the timing and nature of these changes. This paper advances the understanding of how established businesses contribute to regional economic transformation and offers important insights for policymakers aiming to foster economic resilience and innovation.

Key words: *Economic activity, established businesses, regional disparity, National Classification of Activities, ANOVA*

1. Introduction

The distribution of businesses across economic sectors is essential for understanding socio-economic development. This topic is relevant across disciplines such as economics, sociology, and geography, as economic activities shape community dynamics. Entrepreneurship plays a crucial role in job creation and innovation, with established businesses contributing to economic growth (Pilkova & Kovacicova, 2015). However, traditional economic analyses often emphasize start-ups and business closures, overlooking the dynamics of established businesses.

The academic literature does not offer a universally accepted definition of an established business (Guerrero et al., 2021). Usually, businesses that have been operating for more than 42 months are classified as established, according to the Global Entrepreneurship Monitor (GEM) framework (Global Entrepreneurship Research Association, n.d.).

In Croatia, structural economic changes have been the subject of extensive research, highlighting trends such as tertiarization and deindustrialization, alongside pronounced regional disparities (Peračković et al., 2023; Croatian Chamber of Commerce, n.d.). However, the role of established businesses in driving or adapting to these transitions remains underexplored. In particular, there is a lack of regionally contextualized insights into how and when established businesses alter their principal economic activity. Examining economic fluctuations from the perspective of established businesses reveals complex interactions among individual, organizational, and environmental factors that shape both business behavior and broader economic outcomes.

To this end, the paper analyzes industrial transitions among established businesses in Croatia, with a focus on regional variation. Using statistical analysis of official data, it highlights disparities across regions and examines how these transitions align with broader development objectives. The findings offer valuable insights for policymakers engaged in regional economic planning.

Accordingly, the main research question guiding this paper is: *How do established businesses in different Croatian regions change their principal economic activities, and what contextual factors influence the timing and direction of these transitions?*

To address this question, the paper pursues the following objectives:

- To analyze regional disparities in the frequency of industrial transitions among established businesses in Istria, Zadar, and Vukovar-Srijem counties;
- To examine the timing of these transitions in relation to business characteristics (e.g., legal form, ownership type, capital origin);
- To explore the extent to which these transitions align with regional development strategies.

The paper is organized into four sections. The second section reviews the existing literature to establish the paper's conceptual foundation. The third outlines the research methodology and presents the results, detailing the analytical techniques used and the key findings. The final section offers conclusions and provides recommendations for future research.

2. Literature review

2.1. Economic activity

2.1.1. The concept and basic characteristics of economic activity

Economic activity is defined as "a combination of resources such as capital goods, labor, production techniques or intermediate products for the purpose of producing goods or services" (Croatian Bureau of Statistics, n.d. a). Such activities are fundamental to economic production, employment, and overall growth. The structure of an economy plays a key role in assessing economic development (Corvellec et al., 2022; Granovetter, 2018). The literature

emphasizes the importance of a contextualized approach in examining the relationship between economic structure and growth, particularly given the uneven geographical distribution of economic activities (Hidalgo, 2021; Henderson et al., 2018). Moreover, diversification of economic structures can enhance stability and foster job creation (Lashitew et al., 2021; Surya et al., 2021), whereas specialization may promote growth but also entails risks of instability and unemployment (Hassink & Gong, 2021; Kemeny & Storper, 2015).

Analyzing economic activity data at the micro level is essential for evidence-based policymaking (van Zanten & van Tulder, 2021). In Croatia, the Croatian Bureau of Statistics (CBS) provides official statistical data in accordance with international standards. The CBS maintains the Register of Business Entities (Register) and issues classification notices to businesses upon registration, based on the National Classification of Activities (NKD).

2.1.2. Change of economic structure

Structural change in the economy involves shifts in production and employment across sectors (Matthess & Kunkel, 2020; Święcki, 2017). Understanding the drivers of such change is complex. As van Neuss (2019) notes, structural shifts are influenced by changes in income, relative (sectoral) prices, input–output linkages, and comparative advantages arising from globalization and trade. Technological innovation plays a key role by enhancing productivity and product quality, thereby aligning production closely with evolving consumer needs (Pan et al., 2022; Krüger, 2008). Demand- and supply-side factors, including income levels, sectoral price shifts, and consumer preferences, further affect resource allocation (Comin et al., 2021; Matsuyama, 2019). In addition, globalization, deindustrialization, and urbanization reshape economic structures by encouraging specialization and productivity gains (Kellner & Kellner, 2021; Peneder & Streicher, 2018). Finally, public policy and institutional frameworks exert an influence on the direction and pace of economic transformation (Coase, 2025; Teixeira & Queirós, 2016).

Croatia's economic structure has been shaped by ongoing demographic and societal transformations. Research highlights key issues such as rising demand for services (Vizek et al., 2023; Gričar et al., 2021). These changes have influenced socio-professional hierarchies and labor market dynamics (Peračković et al., 2023), while economic analyses point to the expanding tertiary sector and the growing regional concentration of economic activities (Mikulić, 2024; Braičić & Lončar, 2018). The Croatian economy remains oriented toward low-skilled service sectors, particularly tourism, which raises potential socio-economic vulnerabilities (Funda et al., 2023). The National Development Strategy of the Republic of Croatia 2030 seeks to address these challenges by promoting smart specialization in export-oriented sectors such as information technology, energy, and manufacturing, while also prioritizing balanced regional development. To this end, tailored economic policies are needed to address the distinct needs of different regions (Singer et al., 2024; Marošević, 2021).

2.2. Established businesses

2.2.1. The concept and basic characteristics of established businesses

The GEM framework emphasizes distinct characteristics between nascent and established businesses. According to Guerrero et al. (2021), a business is considered established if it meets one or more of the following criteria: sustained operation over time, demonstrated

stability and market presence, or affiliation with a relevant demographic group. These criteria reflect temporal, structural, sectoral, and demographic dimensions of business activity.

The behavior of owner-managers, particularly in relation to innovation and competitive advantage, has been extensively examined, with human capital identified as a key factor in decision-making processes (Expósito et al., 2023; Širec & Močnik, 2018). Education plays a critical role in enhancing entrepreneurial competencies, underscoring its importance for long-term business sustainability (He et al., 2024). Innovation has become increasingly important for maintaining competitive advantage, and research suggests that gender also influences patterns of entrepreneurial behavior (Huang et al., 2022; Širec & Močnik, 2015).

Regarding performance outcomes, research suggests that established businesses tend to be more innovative than start-ups (Dinesh & Sushil, 2021; Snihur & Wiklund, 2019). However, some studies argue that they may exert a negative impact on economic growth (Gaba & Gaba, 2022; Meyer, 2017).

2.2.2. Established entrepreneurs and changes of economic structure

Entrepreneurs often face challenges that prompt them to abandon existing businesses or shift to new business areas (Kuosmanen & Kuosmanen, 2024). Several factors can influence these decisions, including regional industry diversity, trade openness, and the availability of skilled labor (Yu & Plummer, 2022). Government policies also play a significant role by encouraging transitions through various incentives or regulatory measures (Dong et al., 2024). Market feedback is another critical driver, as underperforming businesses are more likely to switch industries (Liu, 2022).

In this context, established businesses often face challenges when adapting to new sectors, such as high switching costs and the risk of organizational inertia (Zuzul & Tripsas, 2020; Noseleit, 2013). Meanwhile, Neffke et al. (2018) emphasize that established businesses tend to reinforce regional specialization, whereas new businesses play a more prominent role in driving diversification.

Understanding changes in the economic activities of established businesses can enhance risk assessment and strategic planning by improving forecasts of sectoral trends and informing more effective resource allocation (Foerster et al., 2022). Economic fluctuations also reveal patterns in employment, highlighting opportunities for job creation in emerging and expanding sectors (Buera et al., 2022).

3. Methodology and results

3.1. Research area

Croatia is administratively divided into twenty counties, along with the capital city of Zagreb, which holds the status of both a city and a county. These counties vary significantly in terms of economic development. Based on gross domestic product (GDP) per capita, three counties were selected as the focus of this research: Istria (highly developed; ranked 3rd nationally), Zadar (moderately developed; ranked 9th), and Vukovar-Srijem (less developed; ranked 19th) (Croatian Bureau of Statistics, n.d. b).

3.1.1. Istria county

The economy of Istria County is diverse, with tourism serving as a primary driver. Other key sectors include manufacturing, agriculture, and eno-gastronomy, alongside recent growth in the information technology sector (Ministry of Economy of the Republic of Croatia, n.d. a).

In 2022, Istria's GDP per capita was €20,856, representing a 19% increase over the national average. The county accounted for 6% of the national gross value added (GVA), with notable contributions from wholesale and retail trade, transportation and storage, and accommodation and food service activities. By 2024, Istria had 18,400 registered businesses, primarily active in construction, wholesale and retail trade, and professional, scientific, and technical services (Croatian Bureau of Statistics, n.d. b).

The entrepreneurial landscape comprised 12,805 entrepreneurs employing over 57,500 individuals. In 2023, the region recorded a net profit of €484.6 million and an average monthly salary of €1,040, exceeding the national average (Financial Agency, 2024b).

3.1.2. Zadar county

Zadar County is a prominent nautical tourism destination. In addition to tourism, the region's economy is supported by food processing, fishing, mariculture, and seafaring. Zadar is also recognized for its agricultural productivity (Ministry of Economy of the Republic of Croatia, n.d. b).

In 2022, the county's GDP per capita was €14,656, representing 83% of the national average. The county's GVA was approximately €2 million, with key contributions from wholesale and retail trade, transportation and storage, and accommodation and food service activities (Croatian Bureau of Statistics, n.d. b). As of 2024, Zadar County had over 10,000 registered businesses, mainly operating in construction and accommodation and other service activities (Croatian Bureau of Statistics, n.d. b).

The entrepreneurial landscape comprised 6,405 entrepreneurs employing 29,080 individuals. In 2023, these businesses generated a net profit of €390.8 million, with an average monthly salary of €918, below the national average (Financial Agency, 2024a).

3.1.3. Vukovar-Srijem county

Key economic sectors in Vukovar-Srijem County include agriculture and industry, particularly wood processing and food production (Ministry of Economy of the Republic of Croatia, n.d. c). Priority development initiatives focus on enhancing transport and logistics infrastructure, exploring geothermal energy resources, and advancing the regional digital ecosystem (Vukovar-Srijem County Development Agency, 2022).

In 2022, the county's GDP per capita was €10,845, equivalent to 62% of the national average, with a GVA of approximately €1.3 million. Major economic activities include public administration, manufacturing, and wholesale and retail trade (Croatian Bureau of Statistics, n.d. b). By 2024, the county had 5,751 registered businesses, with a significant concentration in the service and retail sectors (Croatian Bureau of Statistics, n.d. b).

In 2023, the entrepreneurial landscape consisted of 2,612 entrepreneurs employing nearly 21,000 individuals. The total net profit amounted to €174.7 million, reflecting a decrease from the previous year. The average monthly net salary was €816, below the national average of €1,028 (Financial Agency, n.d.).

3.2. Data and sample

The data used in this research were obtained from the Register. Although the CBS now classifies businesses according to the NKD 2025 system, this classification came into effect only on January 1, 2025. As NKD 2025 introduced structural changes, comparative data aligned with the previous NKD 2007 classification are not yet available. Therefore, this paper relies on data from an extended time series based on NKD 2007.
The sample includes businesses that meet the following criteria:

1. They changed their principal economic activity code between the introduction of NKD 2007 in February 2008 and July 2024, when the data were collected;
2. They are registered in one of the three selected counties; and
3. They are legally organized as joint-stock companies, limited liability companies, simple limited liability companies, or cooperatives.

These counties were selected to represent Croatia's two broad territorial divisions, Adriatic and Continental, and to reflect varying levels of socio-economic development. In addition, the selection was informed by the authors' regional expertise, thereby enhancing contextual interpretation.

Although the Register includes other legal organizational forms such as institutions, associations, and state or local government bodies, these entities do not typically change their principal economic activities and were therefore excluded from the analysis.

In line with the objective of this paper, the data analysis focuses on businesses that meet two key criteria:

1. Scope of principal economic activity change – the change must occur at the level of the NKD 2007 section, representing a shift between industries, rather than minor adjustments at the division, group, or class level;
2. Business age – businesses must have been registered for at least 42 months, classifying them as established according to the GEM methodology.

A total of 969 businesses satisfied these selection criteria.

3.3. Research results and discussion

Of the total sample, 65.2% of businesses are located in Istria County, 21.4% in Zadar County, and 13.4% in Vukovar-Srijem County. These proportions align with the overall distribution of registered businesses in the three counties during the observed period (Croatian Bureau of Statistics, n.d. c; n.d. d). Moreover, the data support existing findings in the literature regarding the uneven spatial distribution of economic activities in Croatia (Marošević, 2021; Braičić & Lončar, 2018).

Tables 1, 2, and 3 present the basic structural characteristics of the businesses included in the sample.

Table 1: Legal organizational form of businesses

Legal organizational form	Counties	N	Share (%)
Limited liability company	Istria	595	61.4
	Zadar	195	20.1
	Vukovar-Srijem	113	11.7
Simple limited liability company	Istria	37	3.8
	Zadar	8	0.8
	Vukovar-Srijem	13	1.3
Co-operative	Istria	/	/
	Zadar	4	0.4
	Vukovar-Srijem	3	0.3
Joint-stock company	Istria	/	/
	Zadar	/	/
	Vukovar-Srijem	1	0.1
Total		**969**	**100**

Source: Authors

Table 1 shows the dominance of limited liability companies, with the only joint-stock company in the sample registered in Vukovar-Srijem County.

Table 2: Type of ownership of businesses

Type of ownership	Counties	N	Share (%)
Private	Istria	625	64.5
	Zadar	198	20.4
	Vukovar-Srijem	124	12.8
State	Istria	4	0.4
	Zadar	5	0.5
	Vukovar-Srijem	2	0.2
Co-operative	Istria	/	/
	Zadar	4	0.4
	Vukovar-Srijem	3	0.3
Mixed	Istria	3	0.3
	Zadar	/	/
	Vukovar-Srijem	1	0.1
Total		**969**	**100**

Source: Authors

Similarly, Table 2 highlights the predominance of privately owned businesses.

Table 3: Origin of capital of businesses

Origin of capital	Counties	N	Share (%)
Domestic	Istria	503	51.9
	Zadar	180	18.6
	Vukovar-Srijem	107	11
Foreign	Istria	109	11.2
	Zadar	27	2.8
	Vukovar-Srijem	17	1.8

Mixed	Istria	20	2
	Zadar	/	/
	Vukovar-Srijem	6	0.6
Total		**969**	**100**

Source: Authors

While the distribution is somewhat more balanced, Table 3 still indicates a clear dominance of businesses with domestic capital.

Tables 4 and 5 present data on changes in principal economic activity from a temporal perspective.

Table 4: Year of the principal economic activity change

Year	Counties	N	Share (%)
2020	Istria	95	9.8
	Zadar	27	2.8
	Vukovar-Srijem	18	1.9
2021	Istria	72	7.4
	Zadar	25	2.6
	Vukovar-Srijem	16	1.7
2022	Istria	84	8.7
	Zadar	23	2.4
	Vukovar-Srijem	12	1.2
2023	Istria	66	6.8
	Zadar	27	2.8
	Vukovar-Srijem	18	1.9

Source: Authors

Although the dataset spans nearly 17 years, Table 4 reveals that almost half of all changes in principal economic activity (49.8%) occurred between 2020 and 2023. One likely explanation for this concentration is the COVID-19 pandemic. An analysis of key economic indicators shows a strong presence of service-oriented sectors in two of the three counties (Istria and Zadar), with similar trends emerging in Vukovar-Srijem County, where services are increasingly replacing the traditional dominance of agriculture. These findings are consistent with national-level research (Funda et al., 2023; Peračković et al., 2023; Croatian Chamber of Commerce, n.d.), which highlights the pronounced reliance on tourism and related service activities. Given the sector's volatility during the pandemic, it is unsurprising that many businesses strategically adjusted their operations. This trend supports prior research showing that entrepreneurs often pivot to new business areas in response to uncertainty (Kuosmanen & Kuosmanen, 2024; Liu, 2022). Moreover, the results corroborate findings that, while economic specialization can drive growth, it also introduces vulnerability and instability (Hassink & Gong, 2021; Kemeny & Storper, 2015). Although this paper does not focus exclusively on the pandemic period, its findings align with those from similar contexts. For example, research on small and medium-sized tourism enterprises in Turkey (Kahveci, 2023) demonstrates that businesses faced comparable disruptions and adopted short-term survival strategies. In both Croatia and Turkey, strategic flexibility and targeted government support proved essential, though often insufficient for ensuring long-term resilience. These parallels

highlight the broader applicability of this paper's findings within the Mediterranean business landscape.

Table 5: Number of months from registration to change of principal economic activity

Number of months	County			Total sample
	Istria	Zadar	Vukovar-Srijem	
Mean	168.272	162.3	145.415	163.93
Mode	46	61	65	46
Median	155	149	120.5	18.5
Lower quartile	87	81	69.25	83
Upper quartile	236	224	209.75	229.75

Source: Authors

Table 5 illustrates differences in the business life cycle across counties, showing that the highest number of businesses changed their principal economic activity after 46 months in Istria, 61 months in Zadar, and 65 months in Vukovar-Srijem, as recorded in the Register. Tables 6 and 7 present data on changes in principal economic activity based on NKD 2007 classifications.

Table 6: The most common changes among sections of economic activities

County	Sections of economic activities	N	Share in total sample (%)
Istria	G (Wholesale and retail trade; repair of motor vehicles and motorcycles) → C (Manufacturing)	39	4
	G (Wholesale and retail trade; repair of motor vehicles and motorcycles) → I (Accommodation and food service activities)	34	3.5
	G (Wholesale and retail trade; repair of motor vehicles and motorcycles) → F (Construction)	26	2.7
	G (Wholesale and retail trade; repair of motor vehicles and motorcycles) → M (Professional, scientific and technical activities)	26	2.7
Zadar	G (Wholesale and retail trade; repair of motor vehicles and motorcycles) → I (Accommodation and food service activities)	15	1.5
	G (Wholesale and retail trade; repair of motor vehicles and motorcycles) → C (Manufacturing)	10	1
	G (Wholesale and retail trade; repair of motor vehicles and motorcycles) → M (Professional, scientific and technical activities)	8	0.8
Vukovar-Srijem	G (Wholesale and retail trade; repair of motor vehicles and motorcycles) → C (Manufacturing)	19	2
	G (Wholesale and retail trade; repair of motor vehicles and motorcycles) → I (Accommodation and food service activities)	5	0.5
	G (Wholesale and retail trade; repair of motor vehicles and motorcycles) → A (Agriculture, forestry and fishing)	5	0.5
	G (Wholesale and retail trade; repair of motor vehicles and motorcycles) → H (Transportation and storage)	5	0.5
	A (Agriculture, forestry and fishing) → C (Manufacturing)	5	0.5

Source: Authors

Table 6 indicates that, across the entire sample, the most common transitions involve businesses moving from retail trade into manufacturing, accommodation, and other professional activities.

Table 7 further categorizes these inter-sectoral changes according to traditional sectors of the economy, following the classification proposed by Tica et al. (2023).

Table 7: The most common changes among sectors of economic activities

County	Sectors of economic activities	N	Share in total sample (%)
Istria	Tertiary → Quartary	92	13.2
	Tertiary → Secondary	91	9.4
	Quartary → Tertiary	66	6.8
Zadar	Tertiary → Quartary	30	3.1
	Quartary → Tertiary	25	2.6
	Tertiary → Secondary	24	2.5
Vukovar-Srijem	Tertiary → Secondary	31	3.2
	Secondary → Tertiary	13	1.3
	Tertiary → Quartary	9	0.9
	Primary → Secondary	9	0.9

Source: Authors

Given that the sample reflects the national distribution of businesses across economic sectors, it is expected that most changes in economic activity would occur within the extended tertiary sector (comprising tertiary and quaternary activities), as illustrated in Table 7.

The analysis of descriptive statistics reflects the broader economic dynamics within each county and their alignment with regional development goals. In Istria County, a notable trend is the transition away from wholesale and retail trade toward sectors such as accommodation and food services, manufacturing, and construction. This shift corresponds with the strategic priorities outlined in the Development Plan of Istria County for the period 2022–2027 (Istarska županija – Regione Istriana, 2024), which emphasizes sustainable tourism and the diversification of the economic base. The plan identifies tourism and related services, particularly accommodation and food services, as key drivers of regional growth. Additionally, the observed movement from the tertiary to the quaternary sector suggests a growing emphasis on knowledge-intensive activities, consistent with the county's focus on innovation, digitalization, and high-value industries. This trend may indicate a gradual transformation, as businesses adapt to a more service-oriented and knowledge-driven economy, in line with Istria County's long-term goals for innovation and sustainability.

Zadar County exhibited a pronounced shift from wholesale and retail trade to accommodation and food service activities, mirroring trends observed in Istria County. This transition aligns with Zadar's strategic emphasis on tourism development and economic diversification, as outlined in the Zadar County Development Plan 2021–2027 (2022). While the plan acknowledges the region's dependence on tourism, it also highlights the need to diversify into sectors such as technology and manufacturing. The observed changes from tertiary to quaternary sectors suggest that some businesses are pursuing knowledge-based and innovation-driven opportunities. At the same time, the transition from tertiary to secondary sectors reflects the region's gradual integration of industrial activities, likely in response to

strategic objectives aimed at enhancing economic resilience and fostering more sustainable employment.

Vukovar-Srijem County exhibited a distinct pattern compared to Istria and Zadar, with the predominant shift occurring from wholesale and retail trade to manufacturing. This trend suggests a potential resurgence of industrial activity, consistent with the county's economic revitalization strategy. According to the Development Plan of Vukovar-Srijem County for the period 2021–2027 (2022), the region aims to strengthen its industrial base, particularly in manufacturing and agriculture, while also supporting the development of knowledge-based services. Notably, the county showed a higher proportion of businesses transitioning out of agriculture and into manufacturing, indicating a structural shift in the local economy. This movement suggests that traditional industries are being replaced or complemented by more industrialized sectors. The trend also reflects the county's broader efforts to move beyond a reliance on agriculture and toward a more diversified and resilient economic model.

A one-way analysis of variance (ANOVA) was conducted using IBM SPSS Statistics software to examine differences in two dependent variables:

1. the year in which the business changed its principal economic activity; and
2. the number of months between registration in the Register and the change of principal economic activity.

The independent variables reflect various business characteristics:

1. County of registration: Istria, Zadar and Vukovar-Srijem;
2. Legal organizational form: joint-stock companies, limited liability companies, simple limited liability companies and co-operatives;
3. Origin of capital: domestic, foreign and formerly mixed;
4. Type of ownership: state, private, co-operative and formerly mixed
5. Direction of sectoral change: primary, secondary, tertiary, quaternary, quintary; and
6. Direction of section change: based on NKD 2007 classification.

The results are summarized and presented below for each of the independent variables. Full statistical outputs are available upon request from the authors.

Table 8: Summary of ANOVA

Independent Variable	Dependent Variable	Levene's Test Results	ANOVA Results	Scheffe's Test
County of Registration	Year of principal economic activity change	F (2, 966) = 0.939, p = 0.391	No significant differences, F (2, 966) = 0.162, p = 0.850	None
	Months registered until principal economic activity change	F (2, 966) = 0.164, p = 0.849	Significant differences, F (2, 966) = 3.552, p = 0.029	Businesses in Vukovar-Srijem county changed principal economic activity earlier than Istria County by 22.857 months (p = 0.030)
Legal Organizational Form	Year of principal economic	Violation of variance homogeneity, F	Significant differences, F (3, 965) =	Post hoc tests not conducted due to variance issues

Independent Variable	Dependent Variable	Levene's Test Results	ANOVA Results	Scheffe's Test
	activity change	(2, 965) = 16.43, $p < 0.001$	11.709, $p < 0.001$	
	Months registered until principal economic activity change	Violation of variance homogeneity, F (2, 965) = 55.925, $p < 0.001$	Significant differences, F (3, 965) = 27.571, $p < 0.001$	Post hoc tests not conducted due to variance issues
Origin of Capital	Year of principal economic activity change	F (2, 966) = 0.914, $p = 0.401$	Significant differences, F (2, 966) = 4.274, $p = 0.014$	Foreign-owned businesses change of principal economic activity occurred later than domestic ones by 0.924 years ($p = 0.017$)
	Months registered until principal economic activity change	Violation of variance homogeneity, F (2, 966) = 10.174, $p < 0.001$	Significant differences, F (2, 966) = 4.564, $p = 0.011$	Foreign-owned businesses changed principal economic activity earlier by 21.758 months compared to domestic capital funded ($p = 0.023$)
Type of Ownership	Year of principal economic activity change	F (3, 965) = 0.442, $p = 0.723$	No significant differences, F (3, 965) = 2.466, $p = 0.061$	None
	Months registered until principal economic activity change	Violation of variance homogeneity, F (3, 965) = 5.39, $p = 0.001$	Significant differences, F (3, 965) = 3.78, $p = 0.010$	Co-operatives/jointly owned businesses changed principal economic activity 168 months earlier than mixed-ownership ones ($p = 0.029$)
Direction of Sectoral Change	Year of principal economic activity change	Violation of variance homogeneity, F (21, 946) = 2.597, $p < 0.001$	Significant differences, F (21, 946) = 2.388, $p < 0.001$	None (post hoc did not reveal sectoral shifts)
	Months registered until principal economic activity change	Violation of variance homogeneity, F (21, 946) = 2.583, $p < 0.001$	Significant differences, F (21, 946) = 2.262, $p = 0.001$	None (post hoc did not reveal sectoral shifts)
Direction of Section Change	Year of principal economic activity change	Violation of variance homogeneity, F (104, 815) = 1.63, $p < 0.001$	Significant differences, F (153, 815) = 1.496, $p < 0.001$	None (post hoc not feasible due to large number of section categories)
	Months registered until principal economic activity change	Violation of variance homogeneity, F (104, 815) = 2.036, $p < 0.001$	Significant differences, F (153, 815) = 1.433, $p = 0.001$	None (post hoc not feasible due to large number of section categories)

Source: Authors

Prior to conducting the ANOVA, key assumptions were tested to ensure the validity of the results. Levene's test was employed to assess the homogeneity of variances for each independent variable. Where this assumption was satisfied, post hoc Scheffé tests were performed to identify specific group differences. However, in cases where Levene's test indicated a violation of homogeneity, post hoc tests were not conducted, in line with statistical guidelines that discourage interpretation under such conditions. Additionally, for variables with a large number of categories, meaningful post hoc comparisons were not feasible and could lead to interpretive ambiguity.

The county of registration significantly influences the timing of changes in principal economic activity (p = 0.029). Post hoc Scheffé tests indicate that businesses in Vukovar-Srijem County made such changes significantly earlier than those in Istria County, by an average of 22.857 months (p = 0.030). However, the year in which the change occurred did not differ significantly across counties (p = 0.850). These results suggest that while businesses in Vukovar-Srijem tend to adapt more quickly, the timing of change may be shaped more by regional challenges or the availability of institutional support than by broader shifts in the economic environment. The regional differences observed in the timing and direction of industrial transitions reflect underlying structural and contextual disparities. These findings align with theories of regional path dependency and entrepreneurial embeddedness, emphasizing the roles of economic structure, institutional frameworks, and sectoral maturity in shaping business behavior (Grillitsch & Sotarauta, 2020).

The analysis of legal organizational form reveals significant differences in both the timing and year of changes in principal economic activity. Although post hoc tests were not conducted due to violations of assumptions, descriptive statistics provide meaningful insights. The most recent changes were observed among simple limited liability companies (M = 2021.47), while joint-stock companies recorded the earliest changes (M = 2012). Furthermore, simple limited liability companies tended to change their principal economic activity much earlier in their life cycle compared to limited liability companies (69.76 months vs. 170.64 months). This suggests that their streamlined structure and greater organizational flexibility may facilitate quicker responses to evolving market conditions or emerging sectoral opportunities.

The origin of capital also significantly influences the timing of changes in principal economic activity. Foreign-owned businesses were found to implement such changes later in calendar years (by 0.924 years; p = 0.017), but within a shorter period following their establishment compared to domestically owned businesses (by 21.758 months; p = 0.023). This pattern may indicate that domestic businesses are more responsive to local market conditions, prompting them to adjust their activities earlier in their operational lifecycle.

The type of ownership also significantly affects the timing of changes in principal economic activity. Cooperatives and jointly owned businesses were found to make changes significantly earlier than mixed-ownership businesses, by an average of 168 months (p = 0.029). This finding suggests that businesses with more centralized decision-making structures or less complex ownership arrangements may be better positioned to respond swiftly to changing economic conditions.

These findings demonstrate that structural attributes, such as legal form, capital origin, and ownership type, significantly influence both the timing and likelihood of industrial transitions. This aligns with institutional and resource-based perspectives of the firm, suggesting that factors like organizational flexibility, capital structure, and ownership configuration shape

entrepreneurial behavior (Barney et al., 2021). From a policy standpoint, this indicates that adaptive capacity is not only regionally conditioned but also structurally embedded within firm characteristics. As a result, there is a clear need for differentiated support schemes tailored to specific business types, rather than applying uniform, "one-size-fits-all" regional policies.

Finally, while the direction of sectoral and section change showed a significant influence on the timing of changes in principal economic activity, the analysis did not identify which specific groups of sectors accounted for these differences. Moreover, post hoc tests were not feasible due to the large number of categories at the section level, which limited the interpretability of detailed group comparisons.

4. Conclusion and implications for further research

This paper has provided an in-depth analysis of changes in principal economic activities among established businesses in three Croatian counties: Istria, Zadar, and Vukovar-Srijem. Through the application of descriptive statistics and ANOVA, the paper highlights regional disparities, identifies key factors influencing these transitions, and explores their implications for Croatia's broader economic structure.

The findings from the descriptive statistics reveal a consistent trend across all three counties, with businesses increasingly shifting away from wholesale and retail trade toward the manufacturing and service sectors, particularly those related to tourism. The results suggest a correlation between these transitions and the strategic goals outlined in regional development plans. In Istria and Zadar, the emphasis on tourism and high-value services is reflected in the observed sectoral changes, while in Vukovar-Srijem, there is a notable shift toward industrial and manufacturing sectors, indicating a strategic focus on economic diversification and resilience. Although the sectoral shifts generally align with regional development priorities, variations in the pace and direction of change highlight the need for context-specific approaches. These trends underscore the importance of tailoring regional development strategies to local conditions to ensure that structural changes support broader goals of economic growth, sustainability, and resilience.

The ANOVA results complement the descriptive statistics by offering deeper insights into the timing and year of changes in principal economic activities, highlighting the influence of regional characteristics, business structures, and sectoral dynamics. In Vukovar-Srijem County, the more rapid pace of change may reflect ongoing economic challenges and revitalization efforts, while in Istria and Zadar, the emphasis on tourism and innovation appears to shape more gradual transitions. These findings underscore the importance of context-specific strategies in influencing business adaptability. They also suggest that policymakers should continue to support flexible business structures and provide tailored institutional assistance, particularly in structurally lagging regions where rapid adaptation may indicate reactive rather than proactive behavior. Moreover, the results offer compelling evidence that structural business attributes, such as legal form, origin of capital, and ownership type, significantly affect the timing and likelihood of industrial transitions. For instance, the earlier transitions observed among simple limited liability companies suggest a higher degree of responsiveness to environmental changes, likely due to their simplified governance and lower institutional inertia. In contrast, slower transitions among foreign-owned firms may be linked to longer strategic planning cycles or greater reliance on

transnational decision-making networks, which may reduce sensitivity to local economic signals.

The findings provide actionable insights for a range of stakeholder groups. For policymakers at both national and regional levels, the results underscore the need for differentiated, business-type-specific support mechanisms that consider variations in ownership structure, capital origin, and legal form. Support schemes should prioritize more flexible legal entities, such as simple limited liability companies, which demonstrate greater adaptive capacity, while also addressing the needs of structurally lagging regions through early-warning systems and targeted capacity-building initiatives. For development agencies, the findings highlight the importance of aligning sectoral diversification strategies with local entrepreneurial capabilities. Business support institutions can leverage these insights to design advisory programs that enable established firms to anticipate and respond proactively to sectoral shifts. Beyond the Croatian context, the patterns identified in this paper may inform structural transformation policies in other EU peripheral regions with similar path dependencies, emphasizing the importance of micro-level adaptability in fostering broader economic resilience.

Despite the valuable insights provided by this paper, particularly regarding the dynamic nature of the Croatian economy and the ways in which established businesses adapt to changing market conditions and strategic priorities, several limitations should be acknowledged. First, businesses often operate across multiple economic activities, which may lead to inaccuracies in data interpretation based on the classification of their principal activity. Additionally, the Register used in this paper does not include natural persons engaged in regulated activities such as crafts, trades, or freelance work. This exclusion limits the sample, particularly in sectors where such forms of economic activity are prevalent. Another limitation concerns the number of variables incorporated into the analysis. While the paper focused on key structural attributes of businesses, the absence of additional variables, such as sector-specific performance metrics or localized market conditions, may have constrained the analytical depth. Furthermore, the findings may not be fully generalizable to all Croatian regions, as the paper was limited to three counties. This geographical limitation restricts the ability to extrapolate the results to areas with different socio-economic contexts. Notably, broader data coverage was constrained by the considerable costs associated with accessing CBS datasets, including fees for data extraction and custom processing, which limited the feasibility of expanding the geographic scope.

Future research could build on this paper in several important ways. First, examining the long-term effects of sectoral transitions on employment patterns, regional competitiveness, and economic growth would provide a more comprehensive understanding of their broader implications. Expanding the geographic scope to include additional counties would enhance the generalizability of findings and enable comparative analyses across diverse regional entrepreneurial ecosystems. Moreover, incorporating qualitative methods, such as interviews with entrepreneurs who have changed their principal economic activity, could offer deeper insights into the motivations and contextual factors driving these decisions. Longitudinal tracking of businesses over time would further clarify the sustained impact of such transitions on firm performance and regional development. Finally, integrating data on institutional support measures and market conditions would help illuminate how external factors shape the adaptability and strategic behavior of established businesses.

REFERENCES

Barney, J. B., Ketchen Jr, D. J., & Wright, M. (2021): ***Resource-based theory and the value creation framework***, Journal of Management, Vol. 47, No. 7, pp. 1936-1955.

Braičić, Z., & Lončar, J. (2018): ***Prostorna koncentracija i regionalna raspodjela gospodarskih djelatnosti u Republici Hrvatskoj***, Hrvatski Geografski Glasnik, Vol. 80, No. 2, pp. 33-54.

Buera, F. J., Kaboski, J. P., Rogerson, R., & Vizcaino, J. I. (2022): ***Skill-biased structural change,*** The Review of Economic Studies, Vol. 89, No. 2, pp. 592-625.

Coase, R. H. (2025): ***The institutional structure of production***, in: Ménard, C., & Shirley, M. M., eds.: Handbook of new institutional economics, Springer Nature Switzerland, Cham, pp. 37-46.

Comin, D., Lashkari, D., & Mestieri, M. (2021): ***Structural change with long-run income and price effects,*** Econometrica, Vol. 89, No. 1, pp. 311-374.

Corvellec, H., Stowell, A. F., & Johansson, N. (2022): ***Critiques of the circular economy***, Journal of industrial ecology, Vol. 26, No. 2, pp. 421-432.

Croatian Bureau of Statistics. (n. d. a.): ***Knjiga KPD 2002***, https://web.dzs.hr/NKD_2007_publikacija.pdf (accessed 15 January 2025)

Croatian Bureau of Statistics. (n. d. b.): ***Statistics in line***, https://podaci.dzs.hr/en/statistics-in-line/ (accessed 17 March 2025)

Croatian Bureau of Statistics. (n. d. c.): ***Archives***, https://podaci.dzs.hr/en/archives/registers/number-and-structures-of-business-entities-by-counties/ (accessed 27 January 2025)

Croatian Bureau of Statistics. (n. d. d.): ***Register of Business Entities***, https://podaci.dzs.hr/en/statistics/register-of-business-entities/ (accessed 12 February 2025)

Croatian Chamber of Commerce. (n. d.): ***Gospodarski profil,*** https://hgk.hr/komora-zagreb/gospodarski-profil (accessed 15 January 2025)

Dinesh, K. K., & Sushil (2021): ***Strategic innovation and entrepreneurial ownership: an analysis using GEM data and fuzzy simulation,*** Benchmarking: An International Journal, Vol. 28, No. 10, pp. 2896-2915.

Dong, J., Yu, Z., Shi, X., & Yang, Y. (2024): ***Industrial policy, product switching, and export performance,*** China & World Economy, Vol. 32, No. 1, pp. 167-196.

Expósito, A., Sanchis-Llopis, A., & Sanchis-Llopis, J. A. (2023): ***CEO gender and SMEs innovativeness: evidence for Spanish businesses***, International Entrepreneurship and Management Journal, Vol. 19, No. 3, pp. 1017-1054.

Financial Agency. (n. d.): ***Usporedba rezultata poslovanja poduzetnika po županijama, u 2023. godini***, https://www.fina.hr/ngsite/content/download/14935/237946/1 (accessed 4 February 2025)

Financial Agency. (2024 a): ***Osnovni financijski rezultati poduzetnika sa sjedištem u Zadarskoj županiji u 2023. godini***, https://www.fina.hr/novosti/osnovni-financijski-rezultati-poduzetnika-sa-sjedistem-u-zadarskoj-zupaniji-u-2023.-godini (accessed 4 February 2025)

Financial Agency. (2024 b): ***Rezultati poslovanja poduzetnika Istarske županije u 2023. godini***, https://www.fina.hr/novosti/rezultati-poslovanja-poduzetnika-istarske-zupanije-u-2023.-godini (accessed 27 January 2025)

Funda, J., Nagle, P. S. O., & Prasad, M. (2023): ***Croatia Country Economic Memorandum: Laying the Foundations-Boosting Productivity to Ensure Future Prosperity - Overview***, World Bank Group, Washington

Gaba, A. K., & Gaba, N. (2022): ***Entrepreneurial Activity and Economic Growth of BRICS Countries: Retrospect and Prospects***, The Journal of Entrepreneurship, Vol. 31, No. 2, pp. 402-424.

Global Entrepreneurship Research Association. (n. d.): ***How GEM Defines Entrepreneurship***, https://www.gemconsortium.org/wiki/1149 (accessed 12 January 2025)

Gollin, D., Jedwab, R., & Vollrath, D. (2016): ***Urbanization with and without industrialization,*** Journal of Economic Growth, Vol. 21, pp. 35-70.

Granovetter, M. (2018): ***The impact of social structure on economic outcomes***, in: Granovetter, M., ed.: The sociology of economic life, Routledge, New York, pp. 46-61.

Gričar, S., Šugar, V., & Bojnec, Š. (2021): ***The missing link between wages and labour productivity in tourism: Evidence from Croatia and Slovenia***, Economic research-Ekonomska istraživanja, Vol. 34, No. 1, pp. 732-753.

Foerster, A. T., Hornstein, A., Sarte, P. D. G., & Watson, M. W. (2022): ***Aggregate implications of changing sectoral trends***, Journal of Political Economy, Vol. 130, No. 12, pp. 3286-3333.

Grillitsch, M., & Sotarauta, M. (2020): ***Trinity of change agency, regional development paths and opportunity spaces***, Progress in human geography, Vol. 44, No. 4, pp. 704-723.

Guerrero, M., Liñán, F., & Cáceres-Carrasco, F. R. (2021): ***The influence of ecosystems on the entrepreneurship process: a comparison across developed and developing economies***, Small Business Economics, Vol. 57, No. 4, pp. 1733–1759.

Hassink, R., & Gong, H. (2021): ***Six critical questions about smart specialization***, in: Lazzeretti, L. et al., eds: Rethinking Clusters, Routledge, New York, pp. 171-187.

He, L., Zheng, L. J., Sharma, P., & Leung, T. Y. (2024): ***Entrepreneurship education and established business activities: An international perspective***, The International Journal of Management Education, Vol. 22, No. 1, 100922.

Henderson, J. V. et al. (2018): ***The global distribution of economic activity: nature, history, and the role of trade***, The Quarterly Journal of Economics, Vol. 133, No. 1, pp. 357-406.

Hidalgo, C. A. (2021): ***Economic complexity theory and applications***, Nature Reviews Physics, Vol. 3, No. 2, pp. 92-113.

Huang, Y., Li, P., Wang, J., & Li, K. (2022): ***Innovativeness and entrepreneurial performance of female entrepreneurs***, Journal of Innovation & Knowledge, Vol. 7, No. 4, 100257.

Istarska županija – Regione Istriana. (2024): ***Plan razvoja Istarske županije za razdoblje 2022.-2027.***, https://www.istra-istria.hr/media/filer_public/f1/f9/f1f99026-7de8-432c-8cd6-781f5698ab27/240221_plan_razvoja_2022-2027.pdf (accessed 17 February 2025)

Kahveci, E. (2023): ***Business strategies for small-and medium-sized tourism enterprises during COVID-19: a developing country case,*** Journal of Hospitality and Tourism Insights, Vol. 6, No. 4, pp. 1569-1593.

Kellner, D., & Kellner, D. (2021): ***Globalization, technopolitics and revolution,*** in: Kellner, D., ed.: Technology and democracy: toward a critical theory of digital technologies, technopolitics, and technocapitalism, Springer VS, Wiesbaden, pp. 153-177.

Kemeny, T., & Storper, M. (2015): ***Is specialization good for regional economic development?*** Regional Studies, Vol. 49, No. 6, pp. 1003-1018.

Krüger, J. J. (2008): ***Productivity and structural change: a review of the literature***, Journal of Economic Surveys, Vol. 22, No. 2, pp. 330-363.

Kuosmanen, N., & Kuosmanen, T. (2024): ***Inter-industry and intra-industry switching as sources of productivity growth: structural change of Finland's ICT industries***, Journal of Productivity Analysis, Vol. 61, pp. 107-120.

Lashitew, A. A., Ross, M. L., & Werker, E. (2021): ***What drives successful economic diversification in resource-rich countries?***, The World Bank Research Observer, Vol. 36, No. 2, pp. 164-196.

Liu, M. (2022): ***Crossing Boundaries: Internationalization and Industry Switching in Response to Performance Feedback,*** Academy of Management Proceedings, Vol. 2022, No. 1, 15902.

Marošević, K. (2021): ***Regionalni razvoj i neravnoteže u Republici Hrvatskoj,*** Pravni fakultet, Osijek

Matsuyama, K. (2019): ***Engel's law in the global economy: Demand-induced patterns of structural change, innovation, and trade***, Econometrica, Vol. 87, No. 2, pp. 497-528.

Matthess, M., & Kunkel, S. (2020): ***Structural change and digitalization in developing countries: Conceptually linking the two transformations,*** Technology in society, Vol. 63, 101428.

Meyer, N., & Meyer, D. F. (2017): ***An econometric analysis of entrepreneurial activity, economic growth and employment: The case of the BRICS countries,*** Journal of Economic & Management Perspectives, Vol. 11, No. 2, pp. 429–441.

Mikulić, D. (2024): ***Structural Decomposition of the Economic Growth in the Croatian Economy***, Zagreb International Review of Economics & Business, Vol. 27, No. 2, pp. 311-325.

Ministry of Economy of the Republic of Croatia. (n. d. a.): ***Istria county***, https://investcroatia.gov.hr/en/county-stats/istria-county/ (accessed 9 February 2025)

Ministry of Economy of the Republic of Croatia. (n. d. b.): ***Zadar county***, https://investcroatia.gov.hr/en/county-stats/zadar-county/ (accessed 9 February 2025)

Ministry of Economy of the Republic of Croatia. (n. d. c.): ***Vukovar-Srijem county***, https://investcroatia.gov.hr/en/county-stats/vukovar-syrmia-county/ (accessed 9 February 2025)

Neffke, F., Hartog, M., Boschma, R., & Henning, M. (2018): ***Agents of structural change: The role of firms and entrepreneurs in regional diversification***, Economic Geography, Vol. 94, No. 1, pp. 23-48.

Noseleit, F. (2013): ***Entrepreneurship, structural change, and economic growth,*** Journal of Evolutionary Economics, Vol. 23, pp. 735-766.

Pan, W., Xie, T., Wang, Z., & Ma, L. (2022): ***Digital economy: An innovation driver for total factor productivity,*** Journal of business research, Vol. 139, pp. 303-311.

Pandey, R. et al. (2020): ***What Do We Know About Changing Economic Activity of Firms?,*** Studies in Microeconomics, Vol. 8, No. 2, pp. 149–169.

Peneder, M., & Streicher, G. (2018): ***De-industrialization and comparative advantage in the global value chain***, Economic Systems Research, Vol. 30, No. 1, pp. 85-104.

Peračković, K., Turk, I., & Šikić, L. (2023): ***Tertiarization Process in Croatia - Long Term Changes in the Structure of Economic Activities by Sectors***, Ekonomski pregled, Vol. 74, No. 3, pp. 335-360.

Pilkova, A., & Kovacicova, Z. (2015): ***Specifics of the entrepreneurial activities of slovaks: Evidences based on GEM research,*** Procedia Economics and Finance, Vol. 34, pp. 368-375.

Singer, S., Šarlija, N., Pfeifer, S., & Oberman Peterka, S. (2024): ***Što čini Hrvatsku (ne)poduzetničkom zemljom? GEM Hrvatska 2023,*** CEPOR - Centar za politiku razvoja malih i srednjih poduzeća i poduzetništva, Zagreb

Snihur, Y., & Wiklund, J. (2019), ***Searching for innovation: product, process, and business model innovations and search behavior in established firms***, Long Range Planning, Vol. 52 No. 3, pp. 305-325.

Surya, B., Menne, F., Sabhan, H., Suriani, S., Abubakar, H., & Idris, M. (2021): ***Economic Growth, Increasing Productivity of SMEs, and Open Innovation***, Journal of Open Innovation: Technology, Market, and Complexity, Vol. 7, No. 1, 20.

Święcki, T. (2017): ***Determinants of structural change***, Review of Economic Dynamics, Vol. 24, pp. 95-131.

Širec, K., & Močnik, D. (2015): ***Gender-based Determinants of Innovative Activity in Southeast European Established Entrepreneurs***, in: Ramadani, V. et al., eds.: Female Entrepreneurship in Transition Economies, Palgrave Macmillan, London, pp. 67-86.

Širec, K., & Močnik, D. (2018): ***Determinants of Established Entrepreneurs' Innovative Activity in Northern and Western Europe***, in: Mura, L., ed.: Entrepreneurship - Development Tendencies and Empirical Approach, InTech Open, London, pp. 93-112.

Teixeira, A. A., & Queirós, A. S. (2016): ***Economic growth, human capital and structural change: A dynamic panel data analysis***, Research policy, Vol. 45, No. 8, pp. 1636-1648.

The National Development Strategy of the Republic of Croatia 2030. (2021), https://narodne-novine.nn.hr/clanci/sluzbeni/2021_02_13_230.html (accessed 13 January 2025)

Tica, J., Šagovac, M., & Šikić, L. (2023): ***Analiza strukturnih promjena u sektorima međunarodno utrživih proizvoda i usluga***, Vol. 2023, No. 2, pp. 1-24.

van Delden, A. et al. (2016): ***Accuracy of mixed-source statistics as affected by classification errors,*** Journal of official statistics, Vol. 32, No. 3, pp. 619-642.

Van Neuss, L. (2019): ***The drivers of structural change***, Journal of economic surveys, Vol. 33, No. 1, pp. 309-349.

van Zanten, J. A., & van Tulder, R. (2021): ***Towards nexus-based governance: defining interactions between economic activities and Sustainable Development Goals (SDGs)***, International Journal of Sustainable Development & World Ecology, Vol. 28, No. 3, pp. 210-226.

Vizek, M., Stojčić, N., & Mikulić, J. (2023): ***Spatial spillovers of tourism activity on housing prices: The case of Croatia***, Tourism economics, Vol. 29, No. 5), pp. 1376-1390.

Vukovar-Srijem County Development Agency (2022): ***Development plan of Vukovar-Srijem county for the period 2021-2027***, https://www.ra-vsz.hr/wp-content/uploads/2023/01/Plan-razvoja-Vukovarsko-srijemske-zupanije-za-razdoblje-2021.-2027.-godine-1.pdf (accessed 17 February 2025)

Yu, N., & Plummer, L. (2022): ***Exploring the Regional Factors Facilitating Industry Switching of New Ventures.*** Academy of Management Proceedings, Vol. 2022, No. 1, 15199.

Zadar County (2022): ***Plan razvoja Zadarske županije 2021.-2027.,*** https://www.zadarska-zupanija.hr/images/dokumenti/planski_dokumenti/Plan_razvoja_Zadarske_%C5%BEupanije_2021.pdf (accessed 17 February 2025)

Zuzul, T., & Tripsas, M. (2020): ***Start-up inertia versus flexibility: The role of founder identity in a nascent industry***, Administrative Science Quarterly, Vol. 65, No. 2, pp. 395-433.

A scientific paper

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EVALUATING THE EFFICIENCY OF CROATIAN GENERAL HOSPITALS AMIDST HEALTHCARE REFORM: A DATA ENVELOPMENT ANALYSIS APPROACH

ABSTRACT

Healthcare systems around the world are under increasing pressure to increase efficiency, improve the quality of services and optimize the allocation of resources. In Croatia, the hospital sector has been the subject of numerous reform efforts, culminating in the recent centralization of general hospitals under the jurisdiction of the national government from January 2024. This study examines the efficiency of Croatian general hospitals in the context of ongoing healthcare reforms and uses Data Envelopment Analysis (DEA) to assess differences in hospital performance. DEA is applied to assess the efficiency of individual hospitals, taking into account inputs such as the number of beds and doctors and outputs such as the number of discharged patients and bed days. The results indicate significant differences in efficiency scores, ranging from 0.5 to 1, suggesting significant differences in utilization between hospitals. By applying DEA, this study identifies the efficiency differences between hospitals and highlights the best performing facilities as well as the areas in require of further optimization. Furthermore, the study places these findings in the broader historical context of Croatian hospital sector reforms, including previous initiatives such as the introduction of Diagnosis Related Groups (DRG) payment models and hospital master plans. The findings of this research contribute to the policy discourse on optimizing the healthcare system and provide data-driven recommendations for improving hospital performance. Policy makers and healthcare administrators can use these findings to refine resource allocation strategies and improve operational efficiency. The findings contribute to the broader discourse on hospital modernization and serve as a reference for policy makers seeking to improve hospital efficiency through data-driven strategies.

Key words: *hospital efficiency, Data Envelopment Analysis (DEA), healthcare reform, general hospitals, health policy.*

1. Introduction

Healthcare systems around the world are under pressure to increase efficiency, optimize resource allocation and improve the quality of services. In Croatia, the hospital system has been fundamentally reformed. Since gaining independence in 1991, Croatia has implemented numerous reforms to improve the efficiency, sustainability and quality of the hospital sector. These reforms include changes to healthcare financing models, structural restructuring and new payment mechanisms.

One of the earliest and most significant reforms was the transition from the Yugoslav self-managed healthcare model (Parmelee, 1985) to a Bismarckian health insurance system. This

change was intended to stabilize the financing of healthcare care through the introduction of compulsory health insurance, employer and employee contributions, and complementary private insurance options (Voncina, Dzakula & Mastilica, 2007). While this model provided a structured framework for healthcare financing, it also led to increasing inequality in access to healthcare services, especially in lower income groups (Pristaš et al., 2009; Mastilica & Bozikov, 1999). While privatization improved accessibility in some areas, it exacerbated inequalities between urban and rural populations. People in rural areas had limited access to the privatized services, which led to an imbalance in the availability of health services and disadvantaged marginalized groups (Hebrang et al., 2009. This situation underlines the social inequality that was exacerbated by the privatization process in the Croatian healthcare system.

In 2009, Croatia introduced a reform of the remuneration of hospital services by moving from a fee-based model to a DRG (Diagnosis Related Groups) system. The DRG system aimed to control hospital costs by reimbursing healthcare providers based on the type and severity of medical conditions rather than the number of services provided (Dukić Samaržija et al., 2018). The aim was to promote cost-effective care and reduce unnecessary hospitalizations. While this reform increased patient turnover and led to better cost management (Murgić et al. 2010), implementation challenges and ongoing adjustments were required to maximize efficiency gains and avoid unintended consequences such as underuse in complex cases.

In line with the reform of the DRG system, the National Healthcare Strategy 2012–2020 (Ministry of Health of the Republic of Croatia, 2012) aimed to develop and implement a hospital master plan to rationalize and modernize hospital services (World Bank, 2014). However, the effectiveness of the strategy was undermined by delays in implementation and poor coordination. The strategy aimed to eliminate inefficiencies in hospital networks, improve resource allocation and optimize service delivery, but limited political will and financial constraints prevented its full implementation (Economist Impact, 2019).

In addition, the National Plan for the Development of Clinical Hospital Centers, Clinical Hospitals, Clinics and General Hospitals in the Republic of Croatia 2018–2020 (Ministry of Health of the Republic of Croatia, 2018) aimed to optimize the efficiency of hospitals by rationalizing bed capacities and improving the provision of healthcare services. The main objectives included reducing the average length of stay in hospital, increasing the bed turnover rate and optimizing the distribution of medical personnel to improve patient care. The plan also aimed to modernize hospital infrastructure and equipment to improve treatment outcomes. Despite these efforts, evaluations show that some objectives were not fully achieved due to budgetary constraints and administrative inefficiencies. While the plan led to an improvement in hospital equipment and an expansion of telemedicine services, problems such as unequal distribution of resources and hospital overcrowding remained. While the pilot programs were promising, success on a broader scale depended on sustained political support, better hospital management and continuous monitoring.

Overall, the success of the reforms in the hospital sector was mixed. The switch to the Bismarckian model created a stable financial basis, but raised questions of equity. The National Healthcare Strategy set ambitious goals, but struggled with barriers to implementation. The DRG payment reform improved cost control but required constant improvements to achieve the intended efficiency gains. These past experiences demonstrate the importance of strong governance, financial planning and adaptability for the success of future hospital reforms in Croatia.

On January 1, 2024, as part of the National Healthcare Development Plan 2021–2027 (Ministry of Health of the Republic of Croatia, 2021) and the broader National Development Strategy (2020–2030), the Croatian government took over the direct management of general hospitals, which were previously the responsibility of provincial authorities. These reforms aim to standardize hospital management (unification of hospital operations), improve financial sustainability by reducing inefficiencies and increase the accessibility of services by creating a more coherent healthcare system. A key aspect of this transformation is the restructuring of general hospitals, which play a critical role in the country's healthcare delivery. By integrating reform perspectives, this study places the reforms of the Croatia hospital sector within a broader research framework and examines the justification for centralization by assessing the efficiency of general hospitals and their impact on healthcare resource allocation.

Considerable investments have been made in improving hospital infrastructure, modernizing medical equipment and introducing digital healthcare solutions. In particular, the introduction of telemedicine services, including remote monitoring and teleconsultation centers, aims to close gaps in emergency care and improve coordination between emergency services and hospitals. Despite this progress, there are still efficiency differences between general hospitals in Croatia. The differences in resource utilization, patient outcomes and service delivery necessitate a comprehensive evaluation of hospital performance to inform policy decisions and optimize ongoing reforms. One of the most effective tools for assessing the efficiency of healthcare facilities is Data Envelopment Analysis (DEA).

The aim of this study is therefore to analyze the efficiency of Croatian general hospitals in the context of the ongoing reforms of the healthcare system. Taking into account important input variables such as healthcare personnel and infrastructure investments as well as output indicators such as patient throughput, service quality and clinical outcomes, differences in efficiency between hospitals will be identified. The findings will provide information on the effectiveness of reform measures, highlight the best performing hospitals and suggest areas for further improvement.

2. Literature Review

A substantial body of research has explored efficiency using Data Envelopment Analysis (DEA) as a key methodological tool. DEA has been widely applied to assess hospital performance by examining variations in resource utilization, service delivery, and efficiency improvements (Hollingsworth, 2008). This approach has enabled researchers to identify inefficiencies in healthcare provision, compare hospital performance across different regions, and provide recommendations for optimizing resource allocation (Ozcan, 2014).

Systematic literature reviews have reinforced the importance of DEA in evaluating hospital efficiency. A recent review by Pai, Pakdil & Azadeh-Fard (2024) examined DEA-based studies on acute care hospitals from 1984 to 2022, identifying trends in input-output selection and methodological advancements. The study emphasized the adaptability of DEA across various healthcare settings and underscored its role in informing policy decisions. Similarly, Zubir et al. (2024) conducted a review of DEA applications in hospital efficiency analysis between 2014 and 2022, highlighting best practices in variable selection and methodological consistency. In hospital settings, commonly used inputs for DEA include staff numbers (doctors, nurses), hospital resources (beds, equipment), and financial inputs (budget, operating

costs). Outputs typically focus on patient outcomes, such as recovery rates, length of stay, patient satisfaction, and treatment volume. These variables help measure hospital efficiency by comparing the resources used to the outcomes achieved, enabling performance benchmarking across different healthcare institutions. The use of DEA in healthcare has provided valuable insights into how various healthcare environments function. It allows for the evaluation of individual healthcare providers' performance and the analysis of the efficiency of entire healthcare systems, offering a detailed and adaptable method that reflects the complex nature of medical care (Vajjhala & Eappen, 2024). These reviews confirm that DEA remains a robust tool for assessing hospital efficiency and guiding reforms.

In the Croatian context, hospital efficiency research remains limited but is gradually expanding. Empirical research applying DEA to Croatian hospitals has provided valuable insights into efficiency disparities. Rabar (2013) conducted a DEA-based assessment of Croatian hospitals at county level between 2007 and 2009, revealing significant variations in efficiency levels. In 2024 Arbula Blecich, Dukić Samaržija and Samaržija, examined the technical efficiency of hospital operations across Croatian counties during the period 2019–2022. By comparing their results with Rabar's findings, Arbula Blecich et al. (2024) identify changes in efficiency levels across counties. Some counties that were efficient in the earlier period have maintained or improved their performance, while others have experienced declines. At a hospital level DEA was used to evaluated 63 Croatian hospitals based on selected inputs and outputs (Rabar, 20210). Dukić Samaržija et al. (2018) analyzed hospital level data to evaluate public hospitals in Croatia based on DRG procedure. The study reveals notable differences in efficiency levels among Croatian public hospitals. Some hospitals operate near optimal efficiency, while others lag, indicating potential areas for improvement. Previous research highlighted substantial inefficiencies, suggesting policy interventions were needed to enhance hospital performance.

The findings so far show the importance of continuous efficiency evaluation as a guideline for reforms in the hospital sector. By placing the recent Croatian healthcare reform within this broader research framework, the application of DEA in this study builds on established methods to provide insights into the current state of efficiency of general hospitals in Croatia amidst their new organizational reform.

3. Methodology and data description

This study employs Data Envelopment Analysis (DEA) to assess the efficiency of Croatian general hospitals within the context of ongoing hospital system reforms. DEA is a widely used non-parametric technique for evaluating the relative efficiency of decision-making units (DMUs) by comparing multiple inputs and outputs (Charnes, Cooper & Rhodes, 1978). Given the objective of this research, an input-oriented DEA model is adopted, emphasizing the minimization of resource use while maintaining output levels.

Two basic DEA models are the CCR model (Charnes, Cooper, Rhodes, 1978) and the BCC model (Banker, Charnes, Cooper, 1984). The CCR model assumes constant returns to scale (CRS). It evaluates each DMU based on its ability to maximize outputs for a given level of inputs.

CCR model:

$$\max\theta = \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_r x_{i0}}$$

$$Subject\ to\ \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_r x_{i0}} \leq 1, \quad j = 1, \dots, n;\ with$$

$$u_r, v_i > 0, \quad i = 1 \dots, m; \quad r = 1, \dots s$$

In contrast, the BCC model allows for variable returns to scale (VRS) and recognizes that the relationship between inputs and outputs may not be proportional. The application of the BCC model is particularly appropriate in this context, as it accounts for variable returns to scale, which is crucial when comparing hospitals of varying sizes and capacities.

BCC model:

$$\max\theta = \frac{\sum_{r=1}^{s} u_r y_{r0} - u_0}{\sum_{i=1}^{m} v_r x_{i0}}$$

$$Subject\ to\ \frac{\sum_{r=1}^{s} u_r y_{r0} - u_0}{\sum_{i=1}^{m} v_r x_{i0}} \leq 1, \quad j = 1, \dots, n;\ u_r, v_i \geq 0$$

with u_0 unrestricted in sign

θ stands for the relative efficiency, input and output for DMU j are denoted by y_rj,x_ij>0, (x1j,...,xmj) represents the input vector of DMUj with the input weighting vector (v1,...,vm), and (y1j,...,yqj) represents the output vector of DMUj with the output weighting vector (u1,...,uq).

It is also important to choose the appropriate model orientation. Given the nature of healthcare, which is very complex and subject to great uncertainty, the input-oriented DEA is chosen.

The dataset includes general hospitals across Croatia, covering years 2023 to capture efficiency levels before the implementation of the 2024 reform. Data sources include official records from the Croatian Health Statistics Yearbook. The study applies DEA Solver Pro for efficiency calculations.

This paper applies input-oriented BCC model for assessing the relative technical efficiency of Croatian general hospitals. One of the reasons why static BCC-DEA is preferred to dynamic Window DEA is that it provides projections to the efficiency frontier and provides a reference set in which inefficient DMUs are compared to their similar but efficient peers. The total number of DMUs in this paper is x and the total sum of inputs and outputs is 4.

The selection of inputs and outputs was based in literature review (Zubir et al., 2024; Pai, Pakdil & Azadeh-Fard, 2024; Jung et al., 2023) and data availability. Therefore, the selected inputs — number of beds and number of medical doctors — represent critical hospital resources directly tied to care capacity and workforce availability, both of which are strong predictors of hospital productivity (Chilingerian & Sherman, 2004). Beds reflect infrastructure, while medical doctors capture clinical expertise, both essential for delivering services. These inputs are commonly employed in DEA studies assessing hospital efficiency, as they encapsulate critical aspects of resource availability.

The outputs — number of discharged patients and bed days — capture key hospital functions. The number of discharged patients indicates patient throughput and the hospital's capacity to manage and treat patients successfully (O'Neill et al., 2008). Bed days, defined as the total

number of days patients spend in the hospital, reflect resource utilization and operational workload. These metrics are widely used in DEA applications to measure hospital outputs, as they provide a comprehensive view of service delivery and resource consumption (Zubir et al., 2024).

The input variables (number of beds and doctors) and the output variables (number of discharged patients and bed days) show considerable differences between the hospitals. The number of beds ranges from 76 to 934 (mean: 291.77, SD: 179.60) and the number of medical doctors from 22 to 255 (mean: 115.95, SD: 66.47). The large spread in discharged patients (between 2,824 and 20,107 (mean: 10,060.4, SD: 5,181.3)) and bed days (between 16,783 and 191,763 (mean: 63,205.1, SD: 38,775)) indicates considerable differences in patient turnover and length of stay (Table 1).

Table 1: Statistics on Input/Output Data

	Beds	**MD**	**Discharged patients**	**Bed days**
Max	934	255	20,107	191,763
Min	76	22	2,824	16,783
Average	291.77	115.95	10,060.40	63,205.1
SD	179.60	66.4697	5,181.53	38,775

Source: Author

The wide range in the number of beds and medical doctors suggests substantial disparities in hospital size and resource availability. Larger hospitals may face higher patient complexity, which could lower technical efficiency. Hospitals with higher bed days relative to discharges might struggle with resource turnover, potentially lowering efficiency scores. Smaller hospitals (with fewer doctors and beds) achieving high efficiency scores might be leveraging resources more intensively, while larger institutions may face diseconomies of scale or more complex care needs, reducing relative efficiency.

When selecting input and output variables for the DEA, it is imperative that all inputs and outputs are positively correlated with each other and have non-negative values. The correlation matrix for the selected inputs and outputs is shown in Table 2.

Table 2: Correlation matrix

	Beds	**MD**	**Discharged patients**	**Bed days**
Beds	1	0.84642	0.83524	0.94983
MD	0.84642	1	0.91322	0.896
Discharged patients	0.83524	0.91322	1	0.90539
Bed days	0.94983	0.896	0.90539	1

Source: Author

For the application of DEA, the data must satisfy the condition of isotonicity (Arbula Blecich, 2024) which means that outputs should increase with the growth of inputs. In this case, all input and output variables are positively correlated, which confirms that the condition of isotonicity is satisfied. This relationship confirms the appropriateness of DEA for assessing hospital efficiency.

4. Results and discussion

The DEA analysis reveals substantial efficiency variations among Croatian general hospitals. Efficiency scores range from 0.5 to 1, indicating that some hospitals operate at optimal efficiency while others exhibit significant resource misallocation. The following table presents the results of the DEA analysis using the CCR model for technical efficiency (TE) and the BCC model for pure technical efficiency (PTE). Scale efficiency (SE) is calculated as the ratio of TE to PTE (SE = TE/PTE). In an input-oriented DEA, a score of 1 (100%) means that a DMU is fully efficient, i.e. it operates on the efficiency frontier and uses the lowest possible inputs to produce a certain level of outputs. In contrast, a value of less than 1 means that a DMU is inefficient, i.e. it could reduce its inputs for the same level of output. For example, a score of 0.85 (85%) means that the DMU could reduce its inputs by 15% without affecting output. The closer the score is to 1, the more efficient the unit is, while lower scores indicate greater potential for input reduction to achieve optimum efficiency.

Table 3: The results of technical efficiency of Croatian general hospitals

No.	DMU/general hospital	TE	PTE	SE
1	Zabok	0.902	0.943	0.957
2	Sisak	0.698	0.702	0.995
3	Karlovac	0.793	0.793	1
4	Ogulin	0.776	0.832	0.933
5	Varaždin	0.863	1	0.863
6	Koprivnica	0.822	0.908	0.905
7	Bjelovar	0.611	0.810	0.755
8	Gospić	1	1	1
9	Virovitica	0.923	0.991	0.932
10	Požega	0.866	0.872	0.993
11	Pakrac	1	1	1
12	Slavonski Brod	0.791	0.908	0.871
13	Nova Gradiška	0.728	0.852	0.854
14	Zadar	0.892	1	0.892
15	Našice	0.895	0.897	0.998
16	Šibenik	0.736	0.770	0.956
17	Knin	1	1	1
18	Vinkovci	0.804	0.834	0.964
19	Vukovar	0.541	0.559	0.968
20	Pula	0.796	0.909	0.875
21	Dubrovnik	0.734	0.755	0.972
22	Čakovec	1	1	1
	Average	0.826	0.879	0.940
	Max	1	1	1
	Min	0.541	0.559	0.968
	St Dev	0.124	0.117	1.066

Source: Author

The DEA results show clear patterns of inefficiency due to either overcapacity, suboptimal staffing or both. Hospitals such as Sisak (SE: 0.995, PTE: 0.702) show near optimal scale efficiency but poor pure technical efficiency. This suggests that fundamentally sound facility sizing is undermined by operational deficiencies such as inefficient staff scheduling or workflow bottlenecks — suggesting that process optimization through lean management would yield greater benefits than a reduction in physical capacity. In contrast, Varaždin's exceptional PTE (1.0) combined with a below average SE (0.863) reveals a different challenge: as the largest facility in the sample (934 beds), it suffers from economies of scale where investment in infrastructure has outstripped regional patient demand, necessitating a strategic reduction in beds while maintaining an effective staffing model. Most critically, facilities such as Vukovar (SE: 0.968, PTE: 0.559) have systemic deficits on both fronts, with DEA projections indicating significant overcapacity (-44% beds) and an imbalance in staffing (-53% doctors). This is exacerbated by contextual factors highlighted in the Health Statistics Yearbook (2022), including persistent patient outflow to regional centers and alarmingly low bed turnover (16,783 days compared to the sample average of 63,205), reflecting both structural oversupply and the inability to treat complex cases due to the lack of specialized services.

These different inefficiency factors require customized interventions: process reforms for operationally weak hospitals, capacity rationalization for overburdened hospitals, and comprehensive restructuring for systemically underperforming hospitals. At the same time, this reflects the challenges of implementing structural reforms such as the National Healthcare Strategy (2012–2020) and the National Plan for Hospital Development (2018–2020), which aim to rationalize bed capacity and improve staff distribution.

The projection to the efficiency frontier using the BCC model provides insight into how far inefficient hospitals are from optimal performance and what potential resource adjustments are required to improve efficiency (Table 4).

Table 4: Projection on efficiency frontier (BBC model)

			Beds	MD				
No.	**DMU**	**Score**	**Diff.(%)**	**Diff.(%)**	**Reference set**			
1	Zabok	0.943	5.725	5.725	Varaždin	Pakrac	Knin	Čakovec
2	Sisak	0.702	29.809	29.809	Gospić	Knin	Čakovec	
3	Karlovac	0.793	20.661	20.661	Gospić	Knin	Čakovec	
4	Ogulin	0.831	16.83	19.09	Gospić	Čakovec		
5	Varaždin	1	0	0				
6	Koprivnica	0.908	9.192	9.192	Varaždin	Pakrac	Zadar	Čakovec
7	Bjelovar	0.809	41.611	19.009	Pakrac	Zadar		
8	Gospić	1	0	0				
9	Virovitica	0.991	0.94	0.94	Varaždin	Pakrac	Zadar	Čakovec
10	Požega	0.872	12.787	12.787	Gospić	Knin	Čakovec	
11	Pakrac	1	0	0				
12	Slavonski Brod	0.908	9.184	32.618	Varaždin	Zadar	Čakovec	
13	Nova Gradiška	0.852	14.804	31.941	Gospić	Čakovec		
14	Zadar	1	0	0				
15	Našice	0.896	10.332	10.332	Gospić	Pakrac	Knin	Čakovec
16	Šibenik	0.77	23	42.45	Gospić	Čakovec		
17	Knin	1	0	0				
18	Vinkovci	0.834	16.587	21.081	Gospić	Čakovec		
19	Vukovar	0.559	44.088	53.571	Gospić	Čakovec		
20	Pula	0.909	9.118	27.226	Varaždin	Zadar	Čakovec	
21	Dubrovnik	0.755	24.506	24.506	Varaždin	Pakrac	Zadar	Čakovec
22	Čakovec	1	0	0				
	Average	0.879	13.144	16.406				
	Max	1	44.088	53.571				
	Min	0.559	0	0				
	St Dev	0.117	13.189	15.508				

Source: Author

The efficiency score indicates the current level of technical efficiency of the hospital, while the percentage differences for beds and doctors (MD) indicate the extent to which these inputs should be reduced in order to reach the efficiency frontier. The reference set identifies the efficient hospitals which serve as a benchmark for underperforming hospitals. On average, hospitals would have to cut 13.14% of beds and 16.41% of doctors in order to achieve full efficiency. The standard deviations indicate significant differences between hospitals and reflect the diversity of hospital sizes, patient populations and complexity of care, which pose a major challenge to cost containment under the DRG system while maintaining quality of care, as smaller hospitals may struggle to achieve economies of scale.

The frontier projections quantify the precise resource adjustments required to achieve efficiency, but more importantly, they highlight the systemic deficiencies in the Croatia

hospital network. The 44.1% bed surplus in Vukovar - a region with a shrinking population - stands in stark contrast to the optimal utilization of a comparable infrastructure in Knin and shows how demographic change has rendered historical capacity plans obsolete. Hospitals with large service surpluses such as Vukovar, Bjelovar and Šibenik should consider shifting resources to areas with higher demand or reorganizing internal operations to improve resource turnover. Efficient hospitals such as Gospić and Čakovec should be studied to identify transferable best practices, particularly in terms of adjusting bed capacity and staffing to patient volumes. For smaller hospitals (e. g. Ogulin, Nova Gradiška), efficiency improvements may depend more on specialization of services and networked care models than on a simple reduction of inputs.

Overall, the results confirm the mixed results of the Croatian hospital reforms. While some hospitals have adapted well to the efficiency-oriented reforms, others continue to face structural and administrative barriers. These results confirm the rationale of the 2024 hospital centralization reform, which aims to standardize management practices and create a more coherent, sustainable hospital network. The disparities in efficiency underscore the need for ongoing policy adjustments, sustained investment in infrastructure and digital health, and tailored measures to support underperforming hospitals — ultimately guiding future efforts to overcome inequalities and optimize resource allocation across the Croatian healthcare system.

5. Conclusion

The results of the DEA analysis show significant efficiency differences between Croatian general hospitals and raise critical questions about the ability of central management to eliminate systemic inefficiencies. Full efficiency scores in hospitals such as Gospić, Pakrac, Knin and Čakovec indicate that some facilities are already operating optimally, while others — such as Vukovar (CCR-TE: 0.541) and Bjelovar (CCR-TE: 0.611) — show persistent inefficiencies. These results are in line with previous studies (Arbula Blecich et al., 2024), which show regional differences in terms of resources, infrastructure and the distribution of healthcare personnel. In addition, the introduction of the DRG payment system in 2009 aimed to improve the cost efficiency of hospitals and reduce unnecessary hospitalizations, but studies show that this system sometimes incentivized hospitals to avoid complex, high-cost patients, exacerbating regional inequalities (Dukić Samaržija et al., 2018). This dynamic is reflected in the DEA results: hospitals in less resource-intensive regions or those with a more homogeneous patient population (e. g. smaller hospitals such as Knin and Pakrac) achieved higher efficiency scores, while larger hospitals serving diverse, complex populations struggled to achieve the same level of efficiency. The stark contrast between the highest and lowest performing hospitals suggests that systemic reforms need to go beyond one-size-fits-all solutions and take targeted measures. For example, Vukovar's severe underperformance (requiring a 44% bed reduction to achieve efficiency) requires an immediate reallocation of resources, while moderately inefficient hospitals such as Zabok (TE: 0.943) may require only minor operational adjustments.

The Croatian government's recent centralization reform, which came into force with the Act on Amendments to the Health Care Act of 2023 (Ministry of Health, 2023) and is in line with the National Healthcare Development Plan (2021–2027), aims to improve financial sustainability through standardized hospital operations and optimized resource allocation. While centralized control can improve cost control through economies of scale (Harding & Preker, 2016), evidence from Eastern Europe shows that such reforms alone cannot ensure

efficiency gains (Saltman et al., 2007). This paradox is clearly evident in the Croatian context: although centralized oversight streamlines administration (Kutzin et al., 2010), it simultaneously limits the ability of local hospitals to respond to region-specific healthcare needs, potentially exacerbating inequalities in care.

Our DEA results provide an empirical basis for these policy challenges. The standardization mandate in Article 5 of the Health Law (NN 120/23) could benefit low-performing hospitals like Bjelovar (TE = 0.611), but risks destabilizing the patient-responsive models that make efficient hospitals like Knin (TE = 1.0) successful. Conversely, studies (Panda & Thakur, 2016; Dougherty et al., 2022; Brennan & Wendt, 2021) suggest that decentralized clinical governance can improve responsiveness, patient satisfaction, and quality of care. Article 12 provides a legislative mechanism to preserve the clinical autonomy of high-performing hospitals while centralizing fiscal and infrastructure coordination – a hybrid approach that our findings support. However, this regulatory framework is currently not in line with the WHO's Integrated People-Centered Health Services (IPCHS), as it prioritizes administrative control over patient-centered care coordination - a gap that our results highlight through the better performance of smaller, community-based hospitals. Our findings suggest that future policy adjustments should combine the fiscal benefits of centralization with patient-centered strategies, particularly by empowering communities to reduce unnecessary hospitalizations and by coordinating services regionally. Such an approach would not only remove the unintended incentives of the DRG system, but would also support Croatia's progress towards achieving the SDG 3 quality targets. Our analysis shows concrete possibilities for this balance: Efficient hospitals like Čakovec could serve as regional hubs, sharing resources with neighboring underperforming hospitals while remaining flexible to adapt their services to local demographics.

Future policy adjustments should therefore focus on three priority areas: Investments in infrastructure and workforce must be prioritized in hospitals that have historically underperformed, but must be guided by relevant benchmarks to avoid blanket allocations. Second, regional hospital networks linked by shared specialists or telemedicine could pool resources without compromising the responsiveness of local management, and third, continuous monitoring supplemented by clinical outcomes data would allow for iterative refinement of the centralization process. This nuanced approach could help balance the financial and operational benefits of centralization with the adaptability of local management to ultimately achieve sustainable efficiency gains while ensuring access to and quality of care in all regions.

This study makes an empirical contribution by demonstrating that successful centralization requires tailored, hospital-specific reform strategies. The stark contrast between high-performing hospitals such as Varaždin (PTE=1), whose management models could be replicated, and hospitals such as Vukovar (TE=0.541), which are in need of fundamental restructuring, shows that efficiency differences are due to deep-rooted systemic inequalities. These findings call into question the effectiveness of one-size-fits-all interventions and argue instead for precise measures that address the specific operational challenges and regional context of each individual hospital.

Although this study makes an empirical contribution by providing valuable insights into the efficiency of Croatian general hospitals in the context of ongoing healthcare reforms, some limitations should be noted to support future research efforts. First, the analysis relies on available hospital-level data, which may not capture all relevant factors influencing efficiency

(e.g., patient case complexity, clinical outcomes, or quality of care indicators). For example, not including quality indicators may lead to an overestimation of the efficiency of hospitals with high patient volumes and poorer outcomes - a gap that should be addressed in future studies by including indicators such as readmission rates. Second, this study uses a cross-sectional approach that provides a snapshot of hospital efficiency at a single point in time. As healthcare reforms evolve, efficiency scores may change and longitudinal data would provide more dynamic insights into the impact of the reforms. Conducting a dinamic window DEA analysis could trace efficiency changes before and after the implementation of reforms and shed light on the long-term effects of policy adjustments and hospital centralization. Such an analysis would be particularly valuable to assess whether administrative centralization in 2024 reduces the differences between hospitals such as Gospić (TE: 1) and Vukovar (TE: 0.541). By addressing these limitations and exploring new avenues of research, future studies can deepen the understanding of hospital performance dynamics and provide more nuanced policy recommendations to promote sustainable improvements in healthcare in Croatia and beyond.

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REFERENCES

Arbula Blecich, A. (2024): ***The performance of Croatian hotel companies – DEA window and Malmquist productivity index approach***, Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu, Vol. 42, No. 1; pp. 9-38. https://doi.org/10.18045/zbefri.2024.1.9

Arbula Blecich, A., Dukić Samaržija, N. & Samaržija, L. (2024): ***Investigating the Efficiency of Croatian Hospitals at County Level: Data Envelopment Approach***, in: XIX International Symposium Proceedings Unlocking the Hidden Potentials of Organization Through Merging of Humans and Digitals, Proceedings, pp. 297-305.

Banker, R. D., Charnes, A. & Cooper, W. W. (1984): ***Some models for estimating technical and scale infficiencies in data envelopment analysis***, Management Science, 30(9), pp. 1078-1092.

Brennan, D. & Wendt, L. (2021): ***Increasing Quality and Patient Outcomes with Staff Engagement and Shared Governance*,** OJIN: The Online Journal of Issues in Nursing, Vol. 26, No. 2. https://doi.org/10.3912/OJIN.Vol26No02PPT23

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). ***Measuring the efficiency of decision-making units***. European Journal of Operational Research, 2*(6), 429-444.*

Charnes, A., Cooper, W.W. and Rhodes, E. (1978): ***Measuring the efficiency of decision-making units***, European Journal of Operational Research, 2(6), pp. 429-444.

Chilingerian, J.A. & Sherman, H.D. (2004): ***Health Care Applications***. In: Cooper, W.W., Seiford, L.M., Zhu, J. (eds) Handbook on Data Envelopment Analysis. International Series in

Operations Research & Management Science, vol 71. Springer, Boston, MA. https://doi.org/10.1007/1-4020-7798-X_17

Dougherty, S., Lorenzoni, L., Marino, A. et al. (2022): ***The impact of decentralisation on the performance of health care systems: a non-linear relationship.*** Eur J Health Econ, Vol. 23, pp. 705–715. https://doi.org/10.1007/s10198-021-01390-1

Dukić Samaržija, N., Arbula Blecich, A. & Najdek, T. (2018): **Investigation of the Reimbursement Scheme in Croatian Pzblic Hospitals: a Data Envelopment Analysis Approach**, in: Omazić, M., Roska, V. and Grobelna, A. (ur.) Economic and Social Development – 28th International Scientific conference on Economic and Social Development.

Economist Impact (2019): ***At a Turning Point: Healthcare Systems in Central and Eastern Europe,*** Country profile. American Chamber of Commerce to the EU Croatia, Available at: at_a_turning_point_healthcare_systems_in_central_and_eastern_europe_croatia.pdf

Harding, A. L. & Preker, A. S. (2016): ***Innovations in health service delivery: the corporatization of public hospitals (Chinese),*** Health, nutrition, and population series, World Bank Group. Available at: http://documents.worldbank.org/curated/en/313081515574955479

Hebrang, A., Henigsberg, N., Erdeljić, V., Foro, S., Vidjak, V., Grga, A., & Maček, T. (2003): ***Privatization of the Croatian health care system: Effect on indicators of health care accessibility in general medicine***. Health Policy and Planning*, 18(4), 421–428*. https://doi.org/10.1093/heapol/czg050

Jung, S., Son, J., Kim, C. & Chung, K. (2023): ***Efficiency Measurement Using Data Envelopment Analysis (DEA) in Public Healthcare: Research Trends from 2017 to 2022*,** Processes, 11(3), 811. https://doi.org/10.3390/pr11030811

Kutzin, J., Cashin, C., & Jakab, M. (2010): ***Implementing health financing reform: Lessons from countries in transition.*** European Observatory on Health Systems and Policies, World Health Organization Europe. ISBN: 9789289042116. Available at: https://www.who.int/publications/i/item/9789289042116

Mastilica, M. & Bozikov, J. (1999): ***Out-of-pocket payments for health care in Croatia: Implications for equity,*** Croatian Medical Journal. 40(2). 152-9.

Ministry of health of the Republic of Croatia (2012): ***National Health Care Strategy 2012–2020.*** Available at: https://zdravlje.gov.hr/UserDocsImages/Programi%20i%20projekti%20-%20Ostali%20programi/National%20Health%20Care%20Strategy%202012-2020.pdf (accessed 25 February 2025)

Ministry of health of the Republic of Croatia (2018), ***National Plan for the Development of Clinical Hospital Centers, Clinical Hospitals, Clinics, and General Hospitals in the Republic of Croatia 2018–2020*,** Available at: https://zdravlje.gov.hr/UserDocsImages/2018%20Programi%20i%20projekti/Nacionalni_plan_razvoja_KBC_KB_KL_OB_2018_2020.pdf

Ministry of Health of the Republic of Croatia. (2023): ***Act on Amendments to the Health Care Act***, Narodne novine, 33/23. Available at: https://narodne-novine.nn.hr/clanci/sluzbeni/2023_03_33_582.html

Murgić, M., Radić, J., Rogan, S. & Kusić, Z. (2010): ***Symposium on the Experiences in the Implementation of Healthcare Reform in Croatia***. Acta Clinica Croatica, 49(1), 121-123.

O'Neill, L., Rauner, M., Heidenberger, K. & Kraus, M. (2008): ***A cross-national comparison and taxonomy of DEA-based hospital efficiency studies***, Socio-Economic Planning Sciences, Vol. 42, No.3, pp. 158-189. https://doi.org/10.1016/j.seps.2007.03.001

Ozcan, Y. A. (2014): ***Health care benchmarking and performance evaluation: An assessment using data envelopment analysis*** *(DEA)*. Springer.

Pai, D. R., Pakdil, F. & Azadeh-Fard, N. (2024): ***Applications of data envelopment analysis in acute care hospitals: a systematic literature review, 1984-2022.*** Health Care Manag Sci, Vol. 27, No. 2, pp. 284-312. doi: 10.1007/s10729-024-09669-4.

Panda, B. & Thakur, H.P. (2016): ***Decentralization and health system performance – a focused review of dimensions, difficulties, and derivatives in India***, BMC Health Serv Res, Vol. 16, 561. https://doi.org/10.1186/s12913-016-1784-9

Parmelee, D. E. (1985): ***Whither the state in Yugoslav health care?*** Social Science & Medicine, Volume 21, Issue 7, 719-728. https://doi.org/10.1016/0277-9536(85)90116-9

Pristaš I., Bilić, M., Pristaš, I., Vončina, L. Krčmar, N., Polašek O. & Stevanović R. (2009): ***Health Care Needs, Utilization and Barriers in Croatia– Regional and Urban-Rural Differences***, Coll. Antropol. 33 Suppl. 1: 121–130. Available at: https://hrcak.srce.hr/file/62345

Rabar, D. (2010): ***Efficiency assessment of Croatian hospitals using data envelopment analysis***, Ekonomski pregled, Vol. 61, No. 9, pp. 511-533. Available at: https://hrcak.srce.hr/index.php/59630

Rabar, D. (2013): ***Evaluation of Croatia's regional hospital efficiency: An application of data envelopment analysis***, in: Interdisciplinary Management Research, Proceedings, Opatija, Croatia, ISBN 978-953-253-117-6.

Saltman, R. B., Bankauskaite, V. & Vrangbæk, K. (2007): ***Decentralization in Health Care: Strategies and Outcomes***. New York: McGraw-Hill. Available at: https://eurohealthobservatory.who.int/publications/m/decentralization-in-health-care-strategies-and-outcomes

Vajjhala, N. R., & Eappen, P. (2024): ***Data envelopment analysis in healthcare management: Overview of the latest trends***, in Ajibesin, A. A. & Vajjhala, N. (Eds.). Data Envelopment Analysis (DEA) Methods for Maximizing Efficiency. IGI Global. https://doi.org/10.4018/979-8-3693-0255-2

Voncina, L., Dzakula, A. & Mastilica, M. (2007): ***Health care funding reforms in Croatia: A case of mistaken priorities***, Health Policy, 80(1), 144–157. https://doi.org/10.1016/j.healthpol.2006.02.016

Zubir, M.Z., Noor, A.A., Mohd Rizal, A.M., Harith, A.A., Abas, M.I., Zakaria, Z, et al. (2024): ***Approach in inputs & outputs selection of Data Envelopment Analysis (DEA) efficiency measurement in hospitals: A systematic review***, PLoS ONE, Vol. 19, No.8, e0293694. https://doi.org/10.1371/journal.pone.0293694

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QUALITY AND PERSISTENCE OF EARNINGS: THE CASE OF SARAJEVO STOCK EXCHANGE

ABSTRACT

This study examines the quality and persistence of earnings components in a frontier market context, analyzing 137 public companies listed on the Sarajevo Stock Exchange from 2012 to 2021. The research investigates whether the well-documented persistence hierarchy between cash flows and accruals, as established by Sloan (1996) in developed markets, holds in Bosnia and Herzegovina's emerging economy. Using pooled ordinary least squares and fixed effects regression models, the study evaluates the predictive power of accrual and cash flow components of earnings while controlling for company-level heterogeneity. The results reveal important findings that challenge conventional wisdom from developed markets. First, the persistence coefficients for accruals and cash flows show statistically significant but economically marginal differences, with maximal gaps of just 0.027. The resembling persistence between earnings components stands in contrast to Sloan's findings of a 0.09 persistence gap favouring cash flows. Second, extreme working capital volatility and episodic cash flow shortfalls dominate earnings dynamics and decreasing, but not eliminating, the traditional accrual-cash flow persistence hierarchy. The study proposes two explanations: (1) institutional constraints reduce income smoothing incentives, akin to frontier-market weaknesses; and (2) macroeconomic and operational volatility weakens the traditional persistence differential between accruals and cash flows. These findings have important implications for both theory and practice. Theoretically, they demonstrate how institutional context fundamentally alters the predictive relationships between earnings components. Practically, they caution investors, analysts, and standard-setters against mechanically applying valuation models from mature markets in frontier economies and highlight the need for more sensitive approaches to assessing earnings quality.

Key words: *Earnings, Quality, Cash flow, Accruals.*

1. Introduction

Earnings quality implies earnings that are supported by cash flows and sustainable in the long run. Therefore, current accounting earnings are not good predictor of a company's

performance. First, they are short-term earnings influenced by non-recurring items. Second, earnings are "composed" of cash and accrual components. In short, the money that company earns is not equal to accounting earnings because the calculation of the latter includes non-cash components that are subject to the discretional judgment of management. Graham et al. (1962) define earning power as the level of earnings a company can expect in the next five to ten years. They emphasize the importance of information contained in the components of current earnings for assessing future earning power. In accounting literature, it is assumed that earnings supported by cash flows are more likely to repeat in the future compared to earnings that consist mainly of accruals. In this sense, it is expected that earnings that consist mainly of accruals will be further diluted in the future (Sloan, 1996). Indeed, accruals reflect efforts for more relevant reporting but come at the expense of reliability because their determination involves a degree of subjectivity, leaving enough discretionary space for earnings management in line with the interests of insiders. The accrual component of earnings is based on calculations and allocations, not on actual cash flow, making them more susceptible to manipulation and estimates. It is necessary to distinguish between two types of accruals (Jones, 1991; Albornoz, 2003):

- Non-discretionary component, which corresponds to adjustments to cash flow resulting from the application of accounting standards in a rational manner and taking into account the company's economic development conditions;
- Discretionary component, which corresponds to adjustments to cash flow resulting from the subjective judgment of management in line with their interests regarding earnings.

The distinction between these two types of accruals suggests that earnings manipulation can only be analyzed based on the discretionary accrual component of earnings. However, financial reports only allow for the calculation of the total accruals, so researchers face the problem of separating non-discretionary and discretionary accrual components. The prevailing approach involves first modeling expected non-discretionary accruals, then deriving discretionary accruals as the residual between total and estimated normal accruals. Current methodologies vary significantly in complexity, ranging from simplistic models that equate total accruals with discretion to sophisticated decompositions attempting to isolate genuine discretionary components. However, Dechow et al. (1995) highlight the absence of conclusive evidence regarding the comparative effectiveness of these alternative approaches, underscoring the inherent limitations in accrual decomposition techniques.

Regarding the impact of ownership structure on the quality of reporting, Givoly et al. (2010) test two hypotheses. The demand hypothesis suggests that companies with stronger demands for higher-quality reporting from capital providers, present better earnings quality. In contrast, the “opportunistic behaviour” hypothesis assumes that companies with a dispersed ownership structure present lower earnings quality because their managers have stronger incentives for earnings manipulation (Givoly et al., 2010). The results of their research support the “opportunistic behaviour” hypothesis, that is, private companies have better quality accruals and a lower propensity to manage earnings compared to public companies.

It is well known that less developed capital markets generally have higher concentration of ownership, lower investor protection and weaker transparency (La Porta et al. 1997, 1998, 1999, 2006). Bosnia and Herzegovina is a country with low capital market development in terms of the low rate of population participation in the capital market (measured by the number of shareholders), which is reflected in the low activity and liquidity of the capital

market, as well as in the high concentration of ownership. This is not surprising given that Bosnia and Herzegovina has a relatively low level of investor protection, low transparency in financial and non-financial reporting, and generally low financial literacy of the population. Consequently, there is also a lack of media focus on financial topics and investment culture in general, which is why there is a lack of public interest in the earning power of public companies. Considering the weaknesses of the capital market in the Federation of Bosnia and Herzegovina, the behaviour of companies on the Sarajevo Stock Exchange to some extent resembles that of private companies, which may mean fewer incentives for earnings management. Therefore, the question arises: are cash flow earnings a better signal of earnings persistence compared to accrual earnings for companies operating in a poorly developed capital market?

The remainder of the paper is organized as follows. The second part of the paper summarizes previous research on earnings quality and persistence of cash earnings. The third part of the paper describes the construction of the research sample, defines the research variables, sources of collected data, research hypothesis, and methodology used for testing the proposed research hypothesis. The fourth part of the paper presents the results and discussion of the research results, while the fifth part provides the main conclusions of the paper, research limitations, and guidelines for future research.

2. Previous research

Sloan (1996) investigated the impact of earnings quality on future earnings of companies in the U.S. and the extent to which stock prices reflect information contained in the accrual and cash components of earnings. The research showed greater sustainability of earnings dominated by the cash component, but stock prices do not fully reflect the greater persistence of earnings that can be attributed to the cash flow component and the lower persistence of earnings that can be attributed to the accrual component of earnings. Sloan (1996) excluded the accrual component of earnings related to investment activities, focusing on operating accrual component. However, Richardson et al. (2001) used a more comprehensive measure of accrual earnings determined as the difference between net income and free cash flows and confirmed that the total accrual component of earnings provides an intuitive and robust measure of earnings quality. In other words, information on earnings quality contained in the accrual component is not concentrated in individual categories of accruals. They also documented that current accruals are less persistent than cash flows, while non-current accruals are as persistent as cash flows. A potential explanation for this phenomenon is that current accruals reverse in the next year or even earlier. Thus, companies with extreme current accruals spill over into earnings changes in the next year. In contrast, non-current accruals take longer to reverse, so a reversal in the next year is not certain (Richardson et al. 2001).

Givoly et al. ((2010) examined the earnings quality of private and public companies and documented that private companies have higher-quality accruals and a lower tendency for earnings management than public companies. Similar conclusions were reached by Beatty et al. (2002) in the banking industry. Indeed, the authors documented that public banks are less likely to report earnings declines, underestimate loan loss provisions, and adjust the recognition of realized gains or losses on securities to prevent earnings declines, and report longer series of earnings increases compared to private banks. Such results are attributed to the greater tendency of public banks to manipulate earnings compared to private banks. This

stems from some investors' naive reliance on accounting earnings to form expectations about future earning power (Bhattacharya, 2001). In contrast, Burgstahler et al. (2006) found that earnings management is a characteristic of private companies but occurs more frequently in countries with weaker legal systems. Similarly, Leuz et al. (2003) showed that weak investor protection enables earnings manipulation, reducing financial reporting quality.

3. Research methodology

The research was conducted on a sample of 137 non-financial public companies listed on the Sarajevo Stock Exchange over a period of 10 years (2012-2021). The research period does not extend beyond 2021 due to significant changes in the presentation format of financial statements. Financial companies, such as banks, insurance companies, and leasing companies, were not included in the sample due to the specific nature of their business. The research sample included all companies for which data on the research variables were available. Data were collected from audited financial reports published on the Sarajevo Stock Exchange. The empirical analysis consists of two parts. First, the accrual component of earnings is calculated, which is then included in the panel regression equation along with the cash component of earnings. The study hypothesizes that the accrual component of earnings is less persistent than the cash flow component:

H1: *The accrual component of earnings demonstrates lower persistence than cash flows, leading to predictable future profitability declines for high-accrual firms.*

The test of earnings persistence is focused on the analysis of cash flow from operating activities because this measure is considered less susceptible to manipulation compared to accounting earnings, which contain accrual components, deferred items, valuations, and allocations that involve a high degree of subjectivity (Bernstein, 1993). The accrual component of earnings is typically calculated using the following formula (Healy 1985, Jones Dechow et al. 1995, Sloan, 1996):

$$\mathrm{TA} = (\Delta\mathrm{CA} - \Delta\mathrm{Cash}) - (\Delta\mathrm{CL} - \Delta\mathrm{STD} - \Delta\mathrm{TP}) - \mathrm{Dep} \tag{1}$$

where
$\Delta\mathrm{CA}$ = change in current assets
$\Delta\mathrm{Cash}$ = change in cash and cash equivalents
$\Delta\mathrm{CL}$ = change in current liabilities
$\Delta\mathrm{STD}$ = change in debt included in current liabilities
$\Delta\mathrm{TP}$ = change in income taxes payable
Dep = depreciation and amortization expense

This study deviates from Sloan's (1996) original accruals formula by excluding income taxes payable. This adjustment is necessary because our regression is based on net income after tax as the dependent variable, whereas Sloan employed income before extraordinary items under U.S. GAAP. The methodological difference arises from fundamental reporting variations in accounting standards. IFRS (adopted in this study) no longer permits the extraordinary items classification according to IAS 1 and requires all material gains/losses to be incorporated into normal operating results. Consequently, net income under IFRS provides a more comprehensive measure of performance, aligning with our analytical framework.

The adjusted accruals formula is specified as follow:

$$TA = (\Delta CA - \Delta Cash) - (\Delta CL - \Delta STD) - Dep \quad (2)$$

The empirical test of the hypothesis on the persistence of earnings was tested using the following model:

$$Eearnings_{t+1} = \gamma_0 + \gamma_1 A_t + \gamma_2 CF_t + v_{t+1} \quad (3)$$

where

EPS_{t+1} = earnings in t + 1 period
A_t = accruals in period t
CF_t = cash flows in period t
$\gamma_1 < \gamma_2$

A smaller coefficient for the accrual component reflects the lower consistency of earnings composed of the accrual component compared to earnings that are more covered by cash (Sloan, 1996). The proposed variables were measured as follows:

$$\text{Earnings} = \frac{\text{Net income}}{\text{Average total assets}}$$

$$\text{Accrual component} = \frac{\text{Accruals}}{\text{Average total assets}}$$

$$\text{Cash Flow component} = \frac{\text{Net income} - \text{Accruals}}{\text{Average total assets}}$$

$$\text{Average total assets} = \frac{\text{Total assets}_t - \text{Total assets}_{t-1}}{2}$$

For easier comparison, total earnings, accrual and cash components of earnings were scaled by the size of the total assets or more precisely by the average book value of the company's assets. To ensure the robustness and reliability of our empirical results, we exclude observations in the top and bottom 1% of all continuous variables. The 1% trimming rule is widely adopted in accounting and finance literature (Dechow et al. 2010; Givoly et al. 2017) because it balances sample representativeness, reduces skewness and kurtosis in distributions and ensures stable coefficient estimates in regressions.

4. Research Results and Discussion

Table 1 presents the descriptive statistics of the research sample. Net income shows a modest mean profitability of 0.32% (σ = 4.87%), indicating relatively low earnings in the sample. The large standard deviation relative to the mean suggests substantial cross-sectional variability in performance. Cash flows are positive on average (3.67%, σ = 7.27%), exceeding net income, while accruals are negative (−0.027, σ = 6.99%), a pattern often observed in capital-intensive

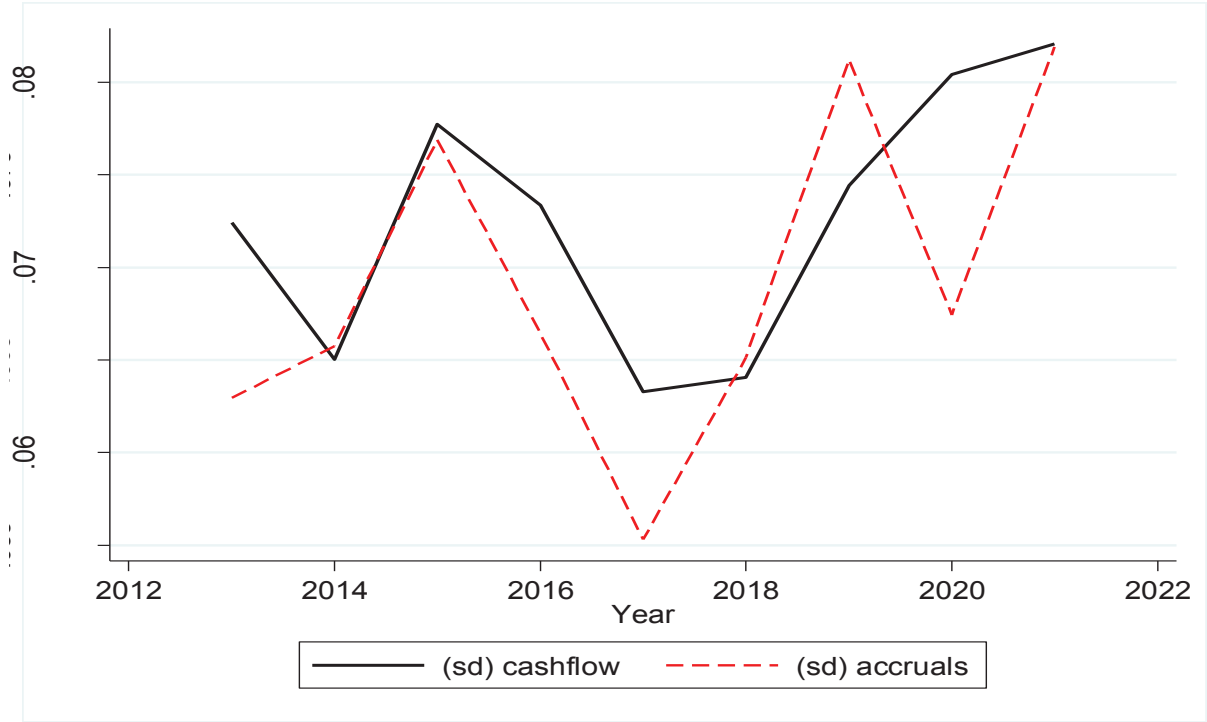
sectors with heavy depreciation. This pattern is especially present in our sample, which contains a significant portion of state owned companies in capital-intensive industries (energy, utilities, mining, defense, etc) and a large proportion of small-cap companies where listing status primarily reflects regulatory compliance rather than active capital-raising options. Notably, these two groups often overlap, meaning that many of the state owned companies, despite their operational scale and maturity, trade as small-cap stocks due to market inefficiencies or institutional constraints. The near-identical standard deviations of accruals and cash flows suggest balanced volatility between these earnings components. Figure 1 plots the annual standard deviations of cash flows and accruals, illustrating how their volatility evolves over time. This pattern is consistent with natural operating cycles or neutral accounting policies that do not indicate income smoothing behaviour.

Table 1: Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Net income	1092	0.0032	0.0487	-0.1819	0.1870
Accruals	1092	-0.0274	0.0699	-0.4328	0.3055
Cash flows	1092	0.0367	0.0727	-0.2211	0.2979

Source: Authors

Figure 1: Annual standard deviations of accruals and cash Flows



Source: Authors

Table 2 shows correlation analysis between net income, accruals and cash flows. The correlations reveal that cash flows (ρ = 0.39) are more strongly tied to net income than accruals (ρ = 0.29), supporting their higher earnings persistence found in Sloan (1996). However, the strong negative correlation between accruals and cash flows (ρ = -0.77) suggests our sample's small-cap companies or IFRS reporting standards may drive aggressive working capital adjustments. While Dechow (1994) interprets such correlations as evidence of

smoothing behaviour, Oh & Penman (2020) contend that extreme accrual volatility typically signals poor earnings quality. Our results support this latter view. While our mean accruals remain modest relative to assets, their increased volatility and strong negative correlation with cash flows reveal two concurrent forces that shape earnings dynamics. First, aggressive working capital adjustments during cash shortfalls emerge as a dominant factor. Second, significant variation arises from heterogeneous accounting policies or operating cycles, as reflected in the high dispersion of accruals. The notion that working capital adjustments behave as mechanical stabilizers rather than discretionary tools aligns with Oh & Penman (2020)'s framework of quality deterioration under institutional constraints. While negative mean accruals might superficially resemble patterns typical for mature companies, their unsteady magnitudes and tight coupling with cash flows point to a fundamentally different mechanism where institutional constraints like small-cap financing limits can force companies to prioritize short-term liquidity survival over intentional income smoothing. In that sense, our study suggests that institutional constraints in underdeveloped capital markets may systematically amplify the accrual noise identified by Dechow & Dichev (2002).

Table 2: Correlation analysis

	Earnings (Net income)	Accruals	Cash Flows
Earnings	1.00		
	-		
Accruals	0.2897	1.00	
	(0.00)	-	
Cash flows	0.3913	-0.7674	1.00
	(0.00)	(0.00)	-

p values in parentheses

Source: Authors

Table 3 displays the estimation results from panel data analysis. Column (2) presents the pooled OLS regression, while columns (3) and (4) report the results of the panel regression with random and fixed effects, respectively.

Table 3: Panel regression analysis

(1) Predictors	(2) Pooled OLS model	(3) Random effects model	(4) Fixed effects model
Accruals	0.634***	0.622***	0.264***
	(22.89)	(22.21)	(5.25)
Cash flows	0.694***	0.681***	0.291***
	(26.48)	(25.59)	(5.91)
Constant	0.0002614	0.000328	0.00279***
	(0.20)	(0.24)	(3.57)
Observations	912	912	912
F test	F(2,909) = 359.69 Prob > F= 0.00		F(2,136) = 17.48 Prob > F= 0.00
Breusch-Pagan LM test		chibar2(01) = 1.65 Prob > chibar2 = 0.0997	R-sq: within = 0.0807 between = 0.8578 overall = 0.4417
Hausman test (FE vs. RE)		chi2(2) = 189.55 Prob>chi2 = 0.0000	

- Since the Modified Wald test for the groupwise heteroscedasticity in fixed effect regression model suggested that we may have problem with heteroscedasticity of variance and Wooldridge test revealed the existence of autocorrelation we conducted a fixed effects model with "robust" variances (Huber, 1967; White, 1980) to address these violations of classical assumptions.

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Authors

From Table 3, it is evident that the coefficient for the accrual component of earnings is lower compared to the coefficient for the cash component of earnings in all models of the panel regression analysis, and the F-test has shown that the hypothesis of equality between these two coefficients cannot be accepted. Pooled OLS shows higher persistence for both accruals (0.634) and cash flows (0.694) compared to fixed effects estimates, suggesting unobserved heterogeneity biases OLS coefficients upward. This aligns with Dechow's (1994) finding that company-specific factors inflate accrual persistence in pooled models. Fixed effects estimates (0.264 accruals, 0.291 cash flows) are more conservative and likely more reliable according to Hausman test. Persistence is, by definition, a time-series property, but estimating dynamic model using Arellano-Bond estimator, cash flows automatically drop out due to high collinearity. This obscures the economic comparison Sloan's hypothesis requires.

Cash flows in fixed effects model remain more persistent than accruals, but both components are less persistent than in Sloan's study (0.86 cash flows, 0.77 accruals), indicating the cash flow superiority observed in developed markets nearly disappears in this context. The near-equivalence of cash flow (0.291) and accrual persistence (0.264) challenges the traditional hierarchy observed in developed markets. This pattern gains further support when compared to the income-only regression (β=0.276) (see Appendix 1, Table 5, column 2). The minimal improvement in explanatory power from splitting income into accrual and cash flow component reinforces the economic insignificance of the cash-accrual persistence gap in Federation of Bosnia and Herzegovina. By using net income as dependent variable we

acknowledge that we deviate from Sloan (1996) and exclude taxes. So, we replicate results with total accruals measured as net income minus cash flow from operating activities. Results are qualitatively similar (see Table 4 in Appendix 1, column 3 and 4), suggesting tax accruals do not drive our findings.

We have also estimated panel regression with control variables (lagged ROA, leverage, log-assets, sales growth and year dummies). Our controlled estimates align with Sloan's hypothesis that cash flows are more persistent than accruals. However, the cash-accrual gap (0.029) is still lower than Sloan's (see Table 4 in Appendix 1, column 2) even though is slightly higher compared to the regression without control variables (0.027). The significant drop in R^2 after including control variables suggests they add little explanatory power beyond accruals and cash flows, consistent with Sloan's findings that these components dominate earnings persistence. This implies that firm characteristics do not meaningfully alter the predictive relationship between accruals, cash flows, and future performance.

Additionally, we divided the research period into two phases: the pre-COVID-19 pandemic era (2012–2019) and the pandemic period (2020–2021). Splitting the research sample into two subsamples increased persistence coefficients for both periods' accruals and cash flows. However, both accruals (0.829 vs. 0.585) and cash flows (0.859 vs. 0.635) showed higher persistence during COVID-19 (see Table 4 in Appendix 1, column 5 and 6). Contrary to expectations of disrupted earnings quality, the COVID period actually enhanced the predictive power of both accruals and cash flows in Bosnia and Herzegovina. This phenomenon may reflect government interventions that temporarily stabilized operations and reduced earnings volatility. The cash-accrual gap was higher for the pre-COVID-19 era (0.05) compared to COVID-19 pandemic era (0.03) but still lower than Sloan's.

Building on the institutional and macro-volatility factors proposed earlier, we identify two possible drivers of the fading persistence differential: (1) institutional constraints reduce income smoothing incentives, akin to frontier-market weaknesses; and (2) macroeconomic and operational volatility weakens the traditional persistence differential between accruals and cash flows. These forces operate through distinct but complementary channels. While institutional underdevelopment weakens traditional income smoothing incentives, the capital-intensive nature of our sample adds asset-driven accrual volatility through large depreciation charges that further erodes persistence differential. Thus, the near-convergence of accrual and cash flow persistence reflects neither pure measurement error nor deliberate smoothing, but rather a mechanical outcome of companies operating under binding liquidity constraints and rigid asset structures. This redefines the boundary conditions of Sloan's hierarchy, showing how institutional and operational contexts jointly reshape earnings quality dynamics.

5. Conclusion

This study analyzes earnings persistence among 137 firms listed on the Sarajevo Stock Exchange (2012–2021), testing whether the cash-accrual persistence hierarchy observed in developed markets holds in Bosnia and Herzegovina's frontier economy. Our results indicate that the traditional persistence gap between cash flows and accruals is markedly smaller in this setting, with economically marginal differences despite statistical significance. This pattern may reflect institutional factors like weaker incentives for earnings smoothing or operational volatility that renders both accruals and cash flows similarly transient.

The findings carry important implications for Bosnia and Herzegovina's financial ecosystem. Policymakers should recognize that weaker earnings persistence hierarchies may reflect institutional underdevelopment, warranting targeted reforms to strengthen enforcement mechanisms. For capital market participants the results underscore the need to supplement earnings-based metrics with alternative indicators like sector-specific cash flow drivers to mitigate the risks of overreliance on transient components. While the findings do not reject the broader persistence hierarchy, they highlight contextual limitations in applying developed-market models to frontier economies. Future research could explore whether this convergence is systematic across emerging markets, disentangling the roles of discretionary smoothing and exogenous shocks.

Finally, it is important to emphasize that, due to the small number of companies within certain industries, the research was not conducted separately for each industry, although this would be necessary for a comprehensive approach to this phenomenon. Indeed, given the nature of certain industries, it is reasonable to expect different approaches to working capital management across industries, which would also be reflected in the level of the accrual and cash components of earnings. Similarly, the varying scope and cycle of investments in certain industries could change the assessment of earnings quality in a particular industry. Ultimately, earnings quality may also depend on the structure and identity of the owners, which, in combination with various external factors such as investor protection, the level of corporate governance culture, and the development of the capital market in general, can influence the incentives for earnings management and the quality of earnings. In this sense, analyzing companies within each industry, as well as analyzing companies based on ownership structure and identity across multiple countries with different legal and financial characteristics represent fertile ground for new research and verification of the conclusions derived from this study.

REFERENCES

Albornoz, B. G. (2003): ***Alisamiento del beneficio y manipulación de ajustes por devengo: Análisis empírico en el contexto español.*** Accounting Research Award "José M.ª Fernández Pirla" (XI Edición), Instituto de Contabilidad y Auditoría de Cuentas, Madrid.

Beatty, A., Ke, B. & Petroni, K.R. (2002): ***Earnings Management to Avoid Declines Across Publicly and Privately Held Banks***, The Accounting Review, Vol. 77, No.3, pp. 547-570.

Bernstein, L. (1993): ***Financial Statement Analysis***, 5th ed, IL. Irvin.

Burgstahler, D.C., Halil, L. & Leuz, C. (2006): ***The Importance of Reporting Incentives: Earnings Management in European Private and Public Firms***, The Accounting Review, Vol. 81, No.5, pp.983-1016.

Bhattacharya, N. (2001): ***Investors trade size and trading responses around earnings announcements: An Empirical investigation***, The Accounting Review, Vol. 76, No.2, pp. 221-244.

Dechow, P. (1994): ***Accounting earnings and cash flows as measures of firm performance: The role of accounting accruals***, Journal of Accounting and Economics Vol. 18, pp. 3-42.

Dechow, P.M., Sloan, R.G. & Sweeney, A.P. (1995): ***Detecting Earnings Management***, The Accounting Review, Vol. 70, No.2, pp. 193-225.

Dechow, P.M. & Dichev, I. (2002): ***The quality of accruals and earnings. The role of accrual estimation errors***, The Accounting Review, Vol. 77, pp. 35-59.

Dechow, P.M. & Schrand, C. (2004): ***Earnings Quality***, Charlottesville, VA: Research Foundation of CFA Institute.

Dechow, P., Ge, W. & Schrand,C. (2010):***Understanding earnings quality: A review of the proxies, their determinants and their consequences***, Journal of Accounting and Economics, Vol 50, No. 2-3, pp.344-401.

Graham, B., Dodd, D. & Cottle, S. (1962): ***Security Analysis: Principles and Techniques***, New York, NY:McGraw-Hill.

Givoly D., Hayn, C. & Katz, S. P. (2010): ***Does public ownership of equity improve earnings quality?*** The Accounting Review, Vol. 85, No. 1, pp. 195–225.

Givoly,D., Hayn,C. & Katz,S. (2017): ***The changing relevance of accounting information to debt holders over time***, Review of Accounting Studies, Vol. 22, No.1, pp. 64-108.

Healy, P.M. (1985): ***The effect of bonus schemes on accounting decisions***, Journal of Accounting and Economics, Vol.7, pp.85-107.

Huber, P. J. (1967): ***The behaviour of maximum likelihood estimates under nonstandard conditions***, In Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability. Berkeley, CA: University of California Press, Vol. 1, pp. 221–233.

Hung, M. (2001): ***Accounting standards and value relevance of financial statements: An international analysis***, Journal of Accounting and Economics, Vol. 30, pp. 401–420.

Jones, J. J. (1991): ***Earnings Management During Import Relief Investigations*****,** Journal of Accounting Research, Vol. 29, No. 2, pp. 193-228.

Kothari, S. P. (2001): ***Capital markets research in accounting***, Journal of Accounting & Economics, Vol. 31, No. 1-3, pp. 105–231.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A. & Vishny, R. (1997): ***Legal determinants of external finance***, Journal of Finance, Vol. 52, No.3, pp. 1131-1150.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A. Vishny, R. (1998): ***Law and finance***, Journal of Political Economy, Vol 106, No.6, pp. 1113-1155.

La Porta, R., Lopez-de-Silanes, F. & Shleifer, A. (1999): ***Corporate ownership around the world***, Journal of Finance, Vol. 54, No.2, pp. 471-517.

La Porta, R., Lopez-de-Silanes, F. & Shleifer, A. (2006): ***What Works in Securities Laws***, The Journal of Finance, Vol. 61 No.1, pp. 1-32

Leuz, C, Nanda, D. & Wysocki, P.D. (2003). Earnings management and investor protection: an international comparison, Journal of Financial Economics, vol. 69, No.3, pp. 505-527.

Oh, H. I, & Penman, S. H. (2020): ***The Accruals-Cash Flow Relation and the Evaluation of Accrual Accounting,*** Available at SSRN: https://ssrn.com/abstract=3616871 or http://dx.doi.org/10.2139/ssrn.3616871

Richardson, S. A., Sloan, R.G., Soliman M.T. & Tuna, A.I. (2001): ***Information in Accruals about Quality of Earnings***, Available at SSRN: https://ssrn.com/abstract=278308 or http://dx.doi.org/10.2139/ssrn.278308

Sloan, R.G. (1996): ***Do Stock Prices Fully Reflect Information in Accruals and Cash Flows about Future Earnings?*** The Accounting Review, Vol. 71, No. 3, pp. 289-315.

White, H. (1980): ***A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroscedasticity***, Econometrica, Vol. 48, pp. 817–830.

Appendix

Table A1: Regressions with control variables and subsamples during COVID-19 and for pre COVID-19 pandemic

Independent variables	(1) FE regression with Sloan accruals and control variables	(2) FE regression with accruals defined as Net income – CFO	(3) FE regression with accruals defined as Net income – CFO and control variables	(4) FE regression with Sloan accruals and control variables during COVID-19	(5) FE regression with Sloan accruals and control variables pre-COVID-19
Accruals	0.253***			0.829***	0.585***
	(4.24)			(8.88)	(9.98)
Cash flows	0.282***			0.859***	0.635***
	(4.86)			(9.50)	(11.42)
Lagged ROA	-0.109*		-0.111*	0.0187	0.0952
	(-2.32)		(-2.42)	(0.25)	(1.89)
leverage	0.0108**		0.0110**	-0.00176	0.00208
	(2.68)		(2.79)	(-0.16)	(0.83)
Log assets	-0.0225		-0.0227	0.00141	0.000756
	(-1.82)		(-1.88)	(0.86)	(0.84)
Sales growth	-0.000590***		-0.000585***	-0.0112	0.000102
	(-5.98)		(-5.91)	(-0.90)	(1.22)
	(0.68)		(0.81)	(.)	
Accruals (NI-CFO)		0.275***	0.271***		
		(5.57)	(4.60)		
Cash flow (CFO)		0.284***	0.270***		
		(5.91)	(4.62)		
Constant	0.367	0.00342***	0.371	-0.0242	-0.0135
	(1.82)	(8.33)	(1.88)	(-0.86)	(-0.90)
N	747	907	742	101	646
R-sq:	within = 0.1053 between = 0.0022 overall = 0.0010				

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A2: Regression with earnings as independent variable

	(1) Income (t+1)	(2) Income (t+1)
Accruals	0.264***	
	(7.49)	
Cash flows	0.291***	
	(8.15)	
Income		0.276***
		(8.12)
_cons	0.00279*	0.00361***
	(2.23)	(3.32)
r2_w	0.0807	0.0786
r2_b	0.8578	0.8514
r2_o	0.4417	0.4355
N	912	912

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Authors

A scientific paper

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THE IMPACT OF SELECTED MACROECONOMIC VARIABLES ON THE HAPPINESS INDEX IN EU MEMBER STATES

ABSTRACT

This paper analyses the happiness index in the European Union. Happiness has found its path to the economics, having high importance and influence on numerous indicators. Above all, many recent authors suggest happiness index as one of the alternative measures of economic performance and an important goal for policy creators. The aim of this paper is to bring new insights of the happiness index in the EU27 countries reflected in savings, unemployment rate, living alone, median age of population and real GDP per capita. In order to analyse the importance of happiness in the economy, secondary data is collected from following databases: Eurostat, Country Economy, World Economic Outlook (WEO). The methods used in the paper are regression analysis, correlation analysis and descriptive statistical methods. Findings suggest that for 9 countries in examined period 2015. – 2023., the unemployment rate is not significant for the happiness index. Among those countries two groups can be identified - more developed ones which are among the happiest (Belgium, Ireland, Sweden, Finland), and those in transition, where happiness is not at high levels (Bulgaria, Romania, Estonia, Slovakia, Slovenia). This raises the question about the social awareness, measures of social policies, and national culture of those countries, and leaves space for future research. The relationship between savings and happiness turned out to be ambiguous, while the variables "happiness index" and "one-person household" have a negative relationship in the majority of countries. However, in a small number of countries the relationship between these variables is positive and strong, which can be significant to consider for policy creators, but also an opportunity for reforms in the demographic policy on the EU level, especially when considering the aging of the EU population. To conclude, this paper identified numerous research gaps, so this area of research will continue to be the focus of many scientists, but also useful for policy creators.

Key words: *EU countries, Happiness index, One-person household, Savings, Unemployment rate.*

1. Introduction

Challenges of the modern world have significant influence on modern economy. In such vivid, unpredictable times, the desired goal comes into question: is it still maximizing profit, or something else? In the late 1970s, king Jigme Singye Wangchuck stated, "Gross National Happiness is more important than Gross Domestic Product" (OPHI, 2025). Since then, many

scholars (Stiglitz, Sen, & Fitoussi, 2009, Delhey & Krol, 2013, Costanza et al. 2014) have accepted this claim and advocate the happiness index as a substitutional, or alternative measure for GDP, thus the goal of policy makers. Happiness is influenced by many intrinsic states, and external events, so it is a challenge to determine which variables describe it in the best way, or have the biggest impact, especially considering difference between national cultures.

The aim of this paper is to bring new insights of the happiness index in the EU27 countries reflected in savings, unemployment rate, living alone, median age of population and real GDP per capita. This study fulfils many research gaps, questioning significance of unemployment rate for happiness, and also determining the relationship between aging of population and happiness in EU countries.

Paper consists of five chapters. The opening chapter is Introduction where it has been given the general background, context, and significance of study. Furthermore, in Introduction can be seen main aim of this research. In Chapter 2: Literature review, it has been explained significance of each considered variable and their influence on happiness. All in all, this Chapter also provides insights in levels of happiness in different European countries. In Chapter 3 methodology has been explained. In this chapter, several hypotheses have also been specified. Chapter 4 provides all results. The results confirmed assumptions displayed in the paper. The last chapter shows some conclusion remarks.

2. Literature review

The literature review provides an explanation of why the independent variables were used and their relationship with the dependent variable. Happiness today is usually measured through happiness index, which is composed of indicators in following domains: "life satisfaction, the feeling of happiness, and other happiness domains: psychological well-being, health, time balance, community, social support, education, arts and culture, environment, governance, material well-being, and work" (Musikanski et al., 2017, 5). Frey and Stutzer (2002, 3) underlined that happiness depends on three set of factors: a) demographic and personality factors (e.g., age, gender and family circumstances, as well as nationality, education, and health; b) economic factors (in particular unemployment, income, and inflation); c) political factors (such as the extent of possibilities for citizens to participate in politics, and the degree of governmental decentralisation) to describe happiness. However, in this paper, as the dependent variable it has been used happiness index, in the way it is measured in World happiness reports (happiness ranking is based on a life evaluation question derived from the Cantril Ladder). It asks people to rate their life on a 0-10 scale, from the worst possible life (0) to the best possible life (10) (WHR, 2024). Despite some authors suggested alternative variables that can explain the level of happiness, such as GDP per capita, or Human Development Index (HDI) (Leigh & Wolfers, 2006), in this paper focus is on presenting happiness through variable that incorporates many different aspects of human life that cause oscillation in happiness. Besides, lots of authors agree that happiness should become the main goal for policy creators (Recher, 2022; Bris, 2017), and that GDP is past. Also, many authors wanted to check relationships, causality and oscillations between different selected variables, and happiness in various contexts. Below are some of them.

2.1. Relationship of happiness and other selected variables

Since it is complex to determine what happiness really is, numerous authors tried to find connection between different variables, like happiness (measured through happiness index), and savings and consumption (Guven, 2012), happiness and migration (Graham & Markowitz 2011, Graham & Nikolova, 2018), happiness and labour market outcomes (Krause, 2013, O'Connor, 2020). As such complex index, happiness index can be a good indicator for economic development, especially in terms of sustainable development (Cloutier & Pfeiffer, 2015, 6). Ko et al. (2024, 231) examined "the relationship between climate change and happiness using panel data from 140 countries between 2008 and 2020." As independent variables they used greenhouse gas (GHG) emissions (specifically carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O)], while dependent variable was happiness, and controlling variables: GDP per capita, child mortality, and inequality. Their analysis revealed "that while emissions have limited direct effects on happiness, economic development and public health remain critical drivers of well-being" (Ko et al., 2024, 231). In this research, it is also shown that economic growth plays a key role in forming happiness in developing economies, while "developed countries show a negative association between emissions and happiness, highlighting growing environmental concerns" (Ko et al., 2024, 231).
In many cultures it is known proverb that money cannot buy happiness, and that was one of the first scientific conclusions in this field (Easterlin paradox in 1974). Nevertheless, current papers on this topic give a little different picture. For example, Stevenson & Wolfers (2013) examined World Bank data from more than 150 countries. The main conclusion was that the more money individual has, the happier he/she tends to be. However, Wiblin (2016) underlined that money will make a person a *little* happier, precisely "each doubling of your income correlated with a life satisfaction 0.5 points higher on a scale of 1 to 10." This means, that doubling income may make a person only about 5% happier than he/she is right now (Wiblin, 2016). In general, people tend to be more satisfied when they have some savings. As Evans & Davies (2024, 5) noticed: "while 47% of non-savers were 'mostly' or 'completely' satisfied with their life, this rises to 63% among those saving £300-399 per month." **This is why in this paper we assume that savings and happiness index will have strong and positive correlation**.

Considering relationship between unemployment and happiness, Chadi (2014, 1111) stated that 'The experience of unemployment is one of the most significant causes of unhappiness." Winkelmann (2014), who conducted his research considering data in period 1984 – 2011 for the West Germany, concluded that "average life satisfaction for unemployed workers, at 5.5–6.2 on the 0−10 scale, is always at least a full point below that of employed workers." More than 20 years ago, Wolfers (2003) came up with the results that showed that unemployment has about five times (4.7) bigger impact on the level of happiness than inflation (Caleiras, 2011). Especially vulnerable group are young people, with high expectations and aspirations, regarding the value of their educational degree's, who, mainly in less developed countries cannot get their first job (Dieguez & Fonseca, 2016). Due to complexity of unemployment (it is not always nonvoluntary), some authors questioned previous statement. For example, Ohtake (2012) underlined that perhaps voluntary unemployed individuals reach higher levels of happiness. As one of the potential solutions, Ohtake (2012) advocated creating more jobs, and improving quality of work life. On the other hand, many authors already proved negative effects that unemployment has on the level of happiness (e.g., Mota, 2009; Helliwell, Layard, & Sachs, 2017). **Based on previous conclusions, in this paper we assume that happier countries will have lower unemployment rate.**

Many European countries have decrease in population, and aging of population becomes problem, from many different aspects: demographic policy, pressure on pension system, etc. Scott, Ellison Sinclair (2021, 616) showed that "a slowdown in aging that increases life expectancy by 1 year is worth US$38 trillion, and by 10 years, US$367 trillion." Besides, age of population is linked with some economic trends, like silver economy, so it can generate some new jobs, and business opportunities. According to WHR (2024), globally, the happiest group are still young people aged 15-24. "But this gap is narrowing in Western Europe and recently reversed in North America due to falling life satisfaction among the young." (WHR, 2024, 17). Results of study conducted by Chaudhary & Srivastava (2024, 108) showed "a significant difference in happiness between those seniors who reside with their families, and those who live in retirement homes." On the basis of systematic literature review which included 63 scientific articles published in period 2000 – 2015, Mhaske (2017, 71) concluded that "happiest elders were more likely to be home dwelling elders than institutionalized aged." Although the big part of it plays being surrounded with familiar faces and significant others, it is economically easier to afford petite luxuries, and increase life quality. **We assume that higher median age (i.e., an older population) positively affects the happiness index, in other words, older nations are happier.**

Previously described variable is tightly linked with one-person household. Living alone has its benefits, but it can be more expensive. Housing affordability becomes a great problem in the whole Europe and is one of the parameters because young people choose to stay with their elders longer than it was usual before. As living in a decent shelter is one of the basic human needs, living in one that does not meet the criteria, highly influence physical health and happiness, causing higher scores on depression and perceived stress scales, as shown in the paper by Cattaneo et al. (2009). Loneliness is another problem – in 2016., research conducted in UK, of more than 300,000 adults, showed that "married people had the highest levels of happiness, averaging 7.67 out of 10, higher than co-habiting, single, widowed or divorced people." (Steel, 2016). Burlina & Rodríguez-Pose (2023) linked the whole economic growth with loneliness, stating that high shares of lonely people undermine it. **Considering living alone, in this paper we assume that happiness index and living alone have strong and negative correlation.**

Oishi et al. (2022) conducted the research where they have established relationship between GDP per capita and happiness. Their findings suggested that, "over the last 5 decades, the income–happiness correlation has increased, not decreased, in the USA and several European countries. The income–happiness correlation tends to get higher when both GDP per capita and income inequality are high, whereas it tends to get lower when GDP per capita and/or income inequality are low" (Oishi et al., 2022, p. 224). In the same article, such connections were not noticed for countries like Japan, or those in Latin America, which is very interesting. Stevenson (2021) in her paper suggested that "once a country reaches a certain level of happiness, excess happiness beyond this tends to dampen growth". **This is why in this paper we will assume negative relationship in a long term.**

Last, but not least, is crisis. During some considered time period, different crises can occur. For example, in 21st century world already experienced global financial crisis, global pandemic, and currently some wars effecting global economy are still in progress. Ko, Leung, & Chen (2025) conducted empirical research, using GMM methodology, gathering data from 134 countries for period 2008 – 2019. One of their key results showed that "economic crises significantly reduce happiness, with debt crises having the strongest effect." Besides, they have concluded that, during economic crises, developing economies experience more drastic

happiness decrease. On the contrary, they noticed that "robust social safety nets and job creation programs mitigate adverse effects on happiness". As many authors previously mentioned, they suggested improvement in international cooperation, especially as an important tool for mitigating global economic downturns, and adopting context-specific strategies (e.g., sustainable development), applicable for regional differences (Ko et al., 2025). Additionally, particular countries in Europe, despite they are perhaps not part of the EU, conduct macroeconomic policy that improves happiness among their populations. As they are known as happiest, we wanted to provide more detail answer on question is Europe really a happy place.

2.2. Is Europe a happy place?

Many happiest countries in the world are located in the Europe (e.g., Finland, Denmark, Switzerland, Island, Norway, Sweden, Luxembourg, Netherlands), with Finland being the happiest country in the world from 2017 onwards (WHR, 2024). Countries where residents were happy above EU average, regarding the considered period (2017 – 2023) are: United Kingdom, Sweden, Netherlands, Luxembourg, Austria, Belgium, Ireland, Czech Republic, Denmark, Finland, Germany. These countries are mainly in Western and Norther Europe, with the exception of Czech Republic, so that country can be a role model for Croatia to improve happiness of its residents. Focusing on countries in region (e.g., Croatia, Slovenia, Serbia, Bosnia and Herzegovina, Montenegro, North Macedonia), another impression is obtained. These countries, in period 2017 – 2024, never reached top 20 happiest countries in the world, with the exception of Slovenia, which was in 21st place in recent period (WHR, 2024). Additionally, considering that happiness index is measured on a scale ranging from 0 to 10 ─ where 0 means "very unhappy" and 10 "very happy" – the highest score of 7,74 (data for Finland, for 2024, according to Statista) is actually not *so* high. It can be concluded that there is significant space for improvement, especially in the context of macroeconomic policies.

The WHR editors (Helliwell et al., 2024) advocate that the goal of government should be to implement policies that would be best to increase happiness in society, i.e., the goal should be enrichment of mankind's feeling of happiness and well-being. The challenge then lies in evaluating happiness-based policies – a complex task that requires careful cost-benefit analyses in terms of well-being created per person (Helliwell et al., 2024). Oishi & Diener (2014, 195) suggested that "self-reported happiness could be used to evaluate public policies." Despite the recent cognitions about the happiness index as an alternative measure of economic progress and growth, many democratic countries are still focused on the traditional way of evaluating it, such as GDP. It remains to be seen whether citizens' happiness would be increased by more effective use of macroeconomic policy instruments that could relax, for example, the cost burden on citizens. In addition, policy changes should be accompanied by an appropriate legislative and normative framework and increase the credibility of institutions by reducing corruption.

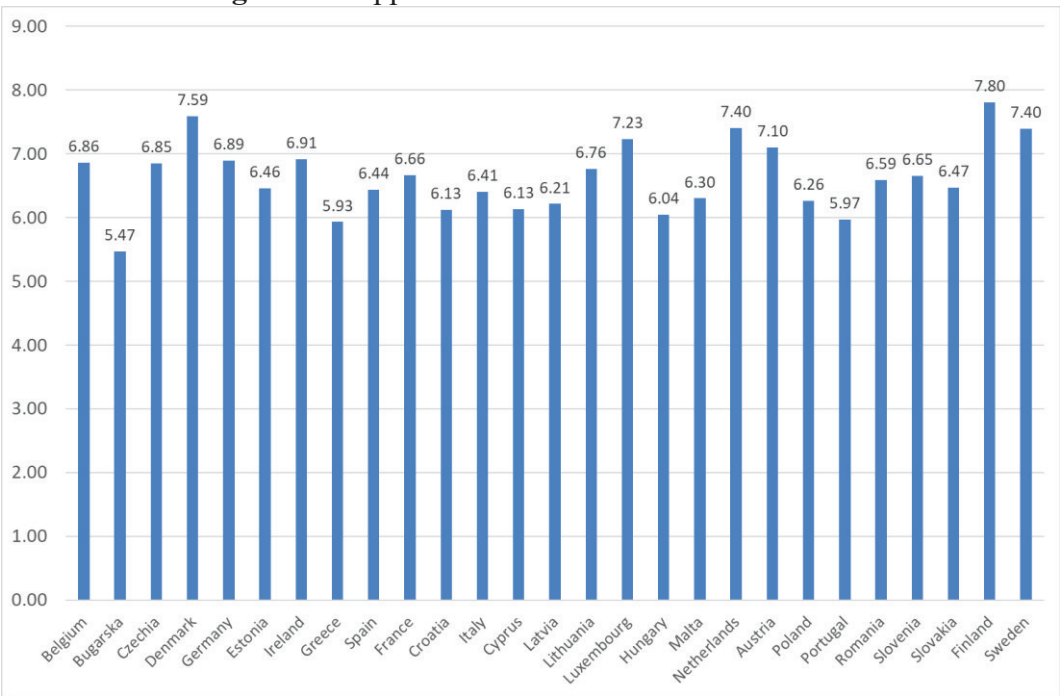
3. Methodology

In the empirical part of the paper, we wanted to check the influence of independent variables on the dependent variable (happiness index), with special focus on two crises in selected countries. The entire considered period is 2015 – 2023, with special emphasis being placed on the segments of this period, as follows:

- Crisis I: corona crisis – year 2020.
- Crisis II: war in Ukraine – year 2022.

To analyse the importance of happiness in the economy, secondary data is collected from following databases: Eurostat, Country Economy, World Economic Outlook (WEO). Figure 1 shows the happiness index for the EU countries according to the World Happiness Report 2023.

Figure 1: Happiness index for EU countries. 2023.



Source: World Happiness Report 2023

Figure above shows that Finland has the highest happiness index of 7.80, followed by Denmark with 7.59, and Austria and Finland 7.40. Bulgaria has the lowest happiness index of 5.47, and the following countries are also low: Greece 5.93 and Portugal 5.97. According to the figure, Croatia has a happiness index of 6.44. This puts the country in the middle of the scale - Croatia is not one of the happiest countries, but neither is it one of the worst. It is close to the average, but still behind most countries in Western and Northern Europe. Most countries have an index in the range between 6.0 and 7.5, suggesting that people in EU countries are generally satisfied with their lives.

Based on the literature review, several hypotheses are tested in this article using a panel model (due to the nature of the data):

- Savings and happiness index have strong and positive correlation.
- Happiness index and unemployment rate have strong and negative correlation.
- Higher median age (i.e., an older population) positively affects the happiness index, in other words, older nations are happier.
- Happiness index and living alone have strong and negative correlation.
- GDP per capita and happiness index have strong and negative correlation.

All variables are considered on an annual basis (frequency) and secondary data was used for all variables. Below is a list of the variables considered in the model (Table 1).

Table 1: Considered variables in the model

Variable	Way of measuring variable	Source
Dependent variable		
Happiness_index	Index	World Happiness Report 2023 https://worldhappiness.report/ Country Economy 2024 https://countryeconomy.com/demography/world-happiness-index
Independent variables		
One_person_household	Thousands	Eurostat https://ec.europa.eu/eurostat/databrowser/view/lfst_hhnhtych__custom_15155600/default/table
Median_Age	Age	Eurostat https://ec.europa.eu/eurostat/databrowser/view/demo_pjanind__custom_16259589/default/table?lang=en
Savings_rate	Percentage	Eurostat https://ec.europa.eu/eurostat/databrowser/view/tec00131__custom_16244311/default/table?lang=en
Real_GDP_per_capita	Constant prices	Eurostat https://ec.europa.eu/eurostat/databrowser/view/tipsna40/default/table?lang=en
Unemployment_rate	Percentage	Eurostat https://ec.europa.eu/eurostat/databrowser/view/tps00203/default/table?lang=en

Source: author's own creation according to the mentioned sources, 2025

The statistical tool used in the paper is a panel regression model that contains a dummy variable for Croatia therefore it is a random effects model. The general form of the panel regression is:

$$y_{it}=\alpha+\beta x_{it}+\mu_i+\varepsilon_{it}$$

Dependent varijable y_{it} in our specific model is the ***happiness_index*** for country i in year t and it comes from World Happiness Report 2023. This is an annual assessment of the life satisfaction of citizens all over the world. Respondents rate their current life satisfaction on a scale from 0 to 10, the so-called Cantril scale. On this scale, 0 stands for the worst possible life and 10 for the best possible life.

Independent variables are also included for each country i in year t as follows:
One_person_households variable shows the number of households of individuals living alone
Median_age is an indicator of the oldness of a country's population as it indicates the age level that divides the population into two equal halves 50% of people are younger and 50% of people are older than this age.
Savings_rate is taken from the Eurostat, and it represents gross savings rate of households defined as gross savings divided by gross disposable income.
Real_GDP_per_capita and ***Unemployment_rate*** are also taken from the Eurostat database and represent standard macroeconomic indicators of the country. As there is a high correlation between these indicators and savings, three equations were estimated, each containing individual macroeconomic indicators.

The oscillations of variables are especially considered in crisis segments precisely because of additional specific circumstances that are assumed to be reflected in their increase or decrease (for example, possible GDP oscillations, etc.). To include specific effects of certain years, dummy variables for 2020 and 2022 (***Dummy_2020*** and ***Dummy_2022***) were included in the model. In addition, a dummy variable for ***Croatia*** was included to examine the specificities of the Croatian environment.

4. Results

This chapter presents the results of a panel regression analysis conducted to analyse the effects of the above variables on the happiness index. The analysis included the examination of 27 European Union countries for the period from 2015 to 2023, using the happiness index as the dependent variable. The results presented shed light on the significance and direction of the impact of individual factors on the happiness index, considering the specificities of Croatia and changes over time. Table 2 gives the results of statistical analysis.

Table 2: Results of the panel regression

Dependent variable Independent variables	Happiness_index	Happiness_index	Happiness_index
One_person_houshold	-0.000408* (-2.10)	-0.000375 (-1.45)	-0.000320 (-1.16)
Median_age	0.144*** (8.53)	0.202*** (10.54)	0.184*** (7.24)
Croatia	-0.291 (-0.65)	-1.265* (-1.98)	-1.169 (-1.62)
Dummy_2020	0.128*** (3.55)	-0.0127 (-0.27)	0.0837* (2.15)
Dummy_2022	0.0388 (1.02)	0.103* (2.45)	0.0695 (1.69)
lnGDP_per_capita	1.257*** (11.13)		
Savings_rate		0.0176*** (3.73)	
Unemployment_rate			-0.0245* (-2.56)

* $p < 0.05$. ** $p < 0.01$, *** $p < 0.001$

Source: Authors

The first assumption of the paper was that "savings and happiness index show a strong and positive correlation". As the table above shows, this is confirmed as the savings rate is statistically significant at less than 1%. There are several possible explanations for why saving is positively associated with happiness. People with larger savings may feel more secure in the case of unforeseen events such as illness or job loss. This security can reduce stress and contribute to feelings of happiness. In addition, the money saved allows for more choices in life – travelling, changing jobs, education or less debt, which means less financial stress.

The second assumption was that "happier" countries have a lower unemployment rate, which is also confirmed at the 5% level of statistical significance since the coefficient in the third regression in the table shows a negative relationship between the two variables, meaning that a higher unemployment rate reduces the happiness index in a country. Possible explanation

lies in the fact that people who do not have jobs are more likely to feel less useful or socially disconnected, which can reduce personal happiness. Unemployment also goes hand in hand with lower income, which prevents people from buying as much as they used to be able to, leading to a greater sense of dissatisfaction.

Results in the table also indicate a positive and statistically significant relationship between GDP per capita, median age and happiness index what partially supports assumption that in less developed countries older people will be happier. GDP and unemployment are closely connected and that is why was expected that less developed countries, assuming also having higher unemployment rate have lower happiness index. But when it comes to the age and happiness, countries with higher age median are having higher happiness index. The explanation may be in the fact that usually developed countries, at the same time "happier" countries experience ageing of population.

Finally, negative coefficient along one person households supports statement that countries with lower number of one-person households will have increased level of happiness index. However, composition of households has shown to be statistically significant only in first regression including GDP as a variable.

The coefficient next to the dummy variable for Croatia is negative in all three equations, which confirms that Croatia is below the European average even in a broader context that takes more influences into account. The lockdown year 2020 also proved to be statistically significant for the happiness index, albeit counterintuitively positive and with an increasing happiness index.

5. Concluding Remarks

Despite GDP is still irreplaceable indicator regarding GDP growth, happiness index carving its way among scientists, but also policy creators, to become equally, if not even more, important indicator, especially due to recent challenges in the contemporary surroundings. Previous research enhanced many different variables regarding their influence on happiness index. The aim of this paper was to gain new insights into the happiness index in the EU27 countries and its connection with savings, unemployment rate, living alone, average age of the population, and real GDP per capita. The paper confirms its initial assumptions since results show that a strong positive correlation exists between savings and the happiness index, but also a negative relationship between unemployment and happiness. GDP per capita and median age show a positive correlation with happiness. Furthermore, older populations tend to report higher happiness levels. The negative coefficient for one-person households suggests that countries with more multi-person households tend to be happier, although this was significant only when GDP was included. Croatia consistently falls below the European happiness average, as shown by the negative dummy variable across all regressions. Interestingly, the year 2020—marked by lockdowns—was associated with a rise in happiness, despite expectations to the contrary. All in all, there are still many challenges for policy creators to design adequate policies that will make people happy and, at the same time, to achieve ultimate sustainable growth.

The most important limitation of the paper results from the database, as secondary data from various relevant statistical sources were used. Since they were not collected but downloaded, the study had to be adapted to the available data, which also leads to suggestions for future

studies that would include a larger number of variables and the specifics of individual countries to examine the determinants of the happiness index in a given economy in more detail.

REFERENCES

Bris, A. (2017): ***GDP is dead. Long live 'happiness'***. Available at: https://www.imd.org/research-knowledge/economics/articles/gdp-is-dead-long-live-happiness/

Burlina, C., & Rodríguez-Pose, A. (2023): ***Alone and lonely. The economic cost of solitude for regions in Europe.*** *Environment and Planning* A, 55(8), 2067-2087. https://doi.org/10.1177/0308518X231169286

Caleiras, J. M. A. (2011): ***Para além dos números — as consequências pessoais do desemprego (PhD Thesis***). Faculty of Economics of Coimbra, University of Coimbra, Portugal.

Cattaneo, M. D., Galiani, S., Gertler, P. J., Martinez, S., & Titiunik, R. (2009): ***Housing, health, and happiness***. *American Economic Journal: Economic Policy*, 75-105.

Chadi, A. (2014): ***Regional unemployment and norm-induced effects on life satisfaction.*** *Empirical Economics*, 46(3), 1111–1141. doi:10.100700181-013-0712-7

Chaudhary, S., & Srivastava, S.K. (2021): ***Happiness and Aging: A Comparative Study.*** *Psychology and Education Journal* 55(2):108-113.

Cloutier, S., Pfeiffer, D. (2015): ***Sustainability through happiness: a framework for sustainable development.*** *Sustainable Development*. 23.

Costanza, R., Kubiszewski, I., Giovannini, E., Lovins, H., McGlade, J., Pickett, K. E., Wilkinson, R. (2014): ***Development: Time to leave GDP behind***, *Nature News*, Vol. 505, pp. 283-289.

Delhey, J., Kroll, C. (2013): ***A "happiness test" for the new measures of national well-being: how much better than GDP are they?*** *Human happiness and the pursuit of maximization*, pp. 191-210.

Dieguez, T., & Fonseca, J. (2016): ***Sustainable Entrepreneurship Lab, II.*** *Jornadas de Educação para o Empreendedorismo em Portugal*, 281-294.

Easterlin, R.A. (1974): ***Does Economic Growth Improve the Human Lot? Some Empirical Evidence,*** Editor(s): PAUL A. DAVID, MELVIN W. REDER, *Nations and Households in Economic Growth*, Academic Press, pp. 89-125.

Frey, B.S., & Stutzer, A. (2002): ***The Economics of Happiness.*** WORLD ECONOMICS, Vol. 3, No. 1, pp. 1-17.

Graham, C., & Markowitz, J. (2011): ***Aspirations and Happiness of Potential Latin American Immigrants***. Journal of Social Research and Policy, 2, 9-25.

Graham, C., & Nikolova, M. (2018): ***Chapter 5: Happiness and International Migration in Latin America.*** In R. L. John F. Helliwell, and Jeffrey D. Sachs (Ed.), World Happiness Report 2018 (pp. 88-114). New York.

Guven, C. (2012): ***Reversing the question: Does happiness affect consumption and savings behavior?*** Journal of Economic Psychology, 33(4), 701-717.

Helliwell, J. F., Layard, R., Sachs, J. D., De Neve, J.-E., Aknin, L. B., Wang, S. (Eds.). (2024): ***World Happiness Report 2024.*** University of Oxford: Wellbeing Research Centre.

Helliwell, J., Layard, R., & Sachs, J. (2017): ***World Happiness Report.*** Retrieved on September, 2017, from: http://worldhappiness.report/ed/2017/.

Ko, J., Leung, C.K., Chen, X. (2025): ***Economic crises and happiness: Empirical insights from 134 countries (2008–2019),*** *Development and Sustainability in Economics and Finance*, Vol. 6, 100040, ISSN 2950-5240, https://doi.org/10.1016/j.dsef.2024.100040.

Ko, J., Leung, C.K., Chen, X., Palmer, D.A. (2024): ***From emissions to emotions: Exploring the impact of climate change on happiness across 140 countries***, *Global Transitions*, Vol. 6, pp. 231-240.

Krause, A. (2013): ***Don't worry, be happy? Happiness and reemployment***. Journal of Economic Behavior & Organization, 96, 1-20.

Leigh, A., & Wolfers, J. (2006): ***Happiness and the human development index: Australia is not a paradox.*** Working Paper 11925. Available at: http://www.nber.org/papers/w11925

Mhaske, R. (2017): ***Happiness and Aging.*** *Journal of Psychosocial Research* Vol. 12, No. 1, 2017, pp. 71-79.

Mota, G. A. L. (2009): ***Three Essays on Happiness in economics. Exploring the usefulness of subjective well-being data for the economic analysis of welfare*** (PhD Thesis). School of Economics and Management, University of Porto, Portugal.

Musikanski, Laura; Cloutier, Scott; Bejarano, Erica; Briggs, Davi; Colbert, Julia; Strasser, Gracie; Russell, Steven. Journal of Social Change; Minneapolis Vol. 9, Iss. 1, (2017).

O'Connor, K.J. (2020): ***Life satisfaction and noncognitive skills: effects on the likelihood of unemployment***. Kyklos. doi:10.1111/kykl.12226

Ohtake, F. (2012): ***Unemployment and Happiness***. *Japan Labor Review*, 9(2).

Oishi, S., & Diener, E. (2014): ***Can and Should Happiness Be a Policy Goal?*** *Policy Insights from the Behavioral and Brain Sciences*, Vol. 1, No. 1, pp. 195-203.

Oishi, S., Cha, Y., Komiya, A., & Ono, H. (2022): ***Money and happiness: the income-happiness correlation is higher when income inequality is higher***. *PNAS nexus*, 1(5), pgac224. https://doi.org/10.1093/pnasnexus/pgac224

OPHI. (2025): ***Gross National Happiness.*** Available at: https://ophi.org.uk/gross-national-happiness (accessed 20 February 2025)

Recher, V. (2022): ***BDP kao promašena mjera ekonomske aktivnosti za 21. stoljeće.*** *Oeconomica Jadertina*, 12 (2), 50-64. https://doi.org/10.15291/oec.3842

Scott, A.J., Ellison, M. & Sinclair, D.A. The economic value of targeting aging. Nat Aging 1, 616–623 (2021). https://doi.org/10.1038/s43587-021-00080-0

Statista. (2024). https://www.statista.com/statistics/1225047/ranking-of-happiest-countries-worldwide-by-score/

Steel, M. (2016): ***Measuring National Well-being: At what age is Personal Well-being the highest?.*** Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/measuringnationalwellbeing/atwhatageispersonalwellbeingthehighest

Stevenson, B., & Wolfers, J. (2013): ***Subjective Well-Being and Income: Is There Any Evidence of Satiation?*** The American Economic Review, 103(3), 598–604.

Stevenson, K. (2021): ***Relationship Between Happiness and GDP per Capita Growth.*** Available at: https://bpb-us-w2.wpmucdn.com/wordpress.lehigh.edu/dist/a/1425/files/2021/04/Stevenson-2021.pdf

Stiglitz E., Sen A., Fitoussi J. P. (2009): ***The measurement of economic performance and social progress***. Revisited reflections and overview. Commission on the Measurement of Economic Performance and Social Progress.

Wiblin, R. (2016): ***Everything you need to know about whether money makes you happy***. Available at: https://80000hours.org/articles/money-and-happiness/

Winkelmann, R. (2014). Available at: https://wol.iza.org/articles/unemployment-and-happiness/long

Wolfers, J. (2003): ***Is Business Cycle Volatily Costly?*** Evidence from Surveys of Subjective Well-Being. International Finance, 6.

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REGIONAL DISPARITIES IN DIGITALIZATION: A RURAL-URBAN PERSPECTIVE

ABSTRACT

This study analyses and compares digitalization strategies for promoting sustainable development in two Intermunicipal Communities (CIM) in Portugal, one predominantly rural and the other urban. The research is based on qualitative (interviews) and quantitative (questionnaires) data addressing various themes, namely institutional support for economic development, energy saving, environmental technology/ICT, waste management and water resources, governance, availability of technology/ICT, tourism, security, mobility and transport, and social capital.

The results show that in the rural CIM, digital initiatives are punctual and focused mainly on tourism and local entrepreneurship, suffering from a lack of institutional coordination, resistance to change, especially among older employees, and limited resources. In the urban CIM, digitalization is integrated into various areas such as mobility, industry, climate action or social inclusion, although heterogeneity between municipalities and low levels of digital literacy in certain groups still hinder the uniform adoption of technologies.

As far as the main challenges are concerned, bureaucratic barriers, a lack of funding and poor coordination between local players were identified in rural areas. In the urban environment, a difference in maturity was identified between municipalities within the inter-municipal reality and the resistance of traditional sectors (namely agriculture) which require adapted approaches.

The conclusions underline that, despite the consensus on the importance of digitalization for sustainability, the success of initiatives depends on strategies adapted to the specific characteristics of each territory, the continuous training of human resources and cooperation mechanisms between different levels of governance. The study makes a theoretical contribution to understanding the relationship between digitalization and sustainability in different territorial contexts and, on the practical side, offers recommendations for political decision-makers, managers and companies on good practices to strengthen territorial cohesion and maximize socio-economic and environmental benefits.

Key words: *Digitalization, Sustainability, Rural Development, Urban Development, Intermunicipal Communities.*

1. Introduction

Digitalization and sustainability are emerging as central challenges for contemporary society, demanding the attention of policymakers and companies in the search for solutions to climate change, inequality and balanced economic, social and environmental growth. Digitalization refers to the digital transformation of society (Gradillas & Thomas, 2023), differentiating it from digitization as the process of converting physical information into digital formats (Mondejar et al., 2021). At the same time, sustainability has become an essential pillar of corporate social responsibility, promoting a balance between economic, social and environmental benefits (Ghisellini et al., 2016).

However, although the literature on digitalization in public administration usually focuses on technical, organizational and institutional aspects, we found that there is a gap regarding the investigation of citizens' and representatives' perceptions in rural and urban contexts. In our study, we propose to fill this gap by exploring how institutional norms, social pressures, and socioeconomic conditions influence the acceptance and evaluation of digital initiatives for sustainability. Thus, our research is not limited to analyzing what is implemented but also seeks to understand how contextual specificities shape the perception of the agents themselves, providing a more comprehensive view of the challenges and opportunities inherent to digital transformation in Intermunicipal Communities (CIM).

Considering the above, this study aims to analyze and compare the approach to the impact of the implementation of digitalization for sustainability in different CIM in rural and urban contexts, examining the strategies adopted, the challenges faced and prospects. Based on interviews, we sought to understand how these entities are incorporating digital transformation into their policies and what factors facilitate or hinder this transition. In addition, the relationship between digitalization and sustainability is investigated, assessing whether there are initiatives in place that contribute to the economic, social and environmental development of the regions. Through this comparison, the aim is to identify good practices and opportunities to strengthen digitalization in the inter-municipal context, ensuring more equitable and efficient development.

2. Theoretical Background

2.1. Digitalization

Digitalization represents the adoption or increased use of digital technology by an organization, industry or country (Brennen & Kreiss, 2016). It leads to the transformation of internal models of organizations by changing internal processes, relationships with stakeholders, products and services through information and communication technologies (ICT). Information systems facilitate the provision and sharing of information, structuring, coordinating and automating internal processes (Isensee et al., 2020). Consequently, digitalization transforms the use of information and communication (Brenner & Hartl, 2021) and optimizes the delivery of services and products (El Sawy et al., 2016). The digital era is marked by rapid technological evolution,

promoting accessibility to knowledge and improving communication between different agents of civil society. It stimulates innovation, accelerates economic development and contributes to long-term sustainable growth (Rodrigues & Franco, 2021).

In the process of implementing digitization, at the institutional and organizational level, this process has specific and complex procedures. Organizations are specific entities that operate within a social context, while institutions refer to broader social structures that establish norms, rules and practices that shape the behavior of organizations. The relationship between them is dynamic, with organizations being influenced by institutions, which provide the normative and cultural context in which they operate, while the practices and structures of organizations can, over time, shape and transform the institutions themselves (Greenwood et al., 2014).

In this way, the role of institutions is to guide organizations with the formulation and implementation of policies and strategies that seek the economic and social restructuring of communities. Here, local public administration plays a decisive role in this context, articulating and implementing certain actions adapted to the specific characteristics of each territory (Dale, 2002).

In each territory, this implementation may vary, since the implementation of digitalization in the public administration sector is influenced by various factors. At the local level, political support, interdepartmental collaboration, financial and human resources, organizational culture and external pressures such as citizens' expectations are some of the determinants that can influence the definition of certain directions in local policy (Tat-Kei Ho, 2002).

That said, digitalization in public administration involves close coordination between central and local bodies, with the central government setting guidelines and local bodies responsible for implementing these policies. This interaction combines technical and financial support with regulatory requirements, requiring communication between the various levels of government (Di Giulio & Vecchi, 2023).

2.2. Sustainability

Regarding sustainability, it integrates environmental, social and economic dimensions (Purvis et al., 2019). It is commonly defined as meeting present needs without compromising the ability of future generations (Gibberd, 2015), balancing economic growth, environmental protection and social well-being (Fiorino, 2010). Regarding the economic sustainability in public administration, this consists of the efficient management of the state's financial resources, guaranteeing the continuous and equitable provision of public services without jeopardizing fiscal stability. To achieve this, it is essential to balance income and expenditure, adopt budgetary control policies and promote transparency in the allocation of resources. In addition, economic sustainability requires long-term planning, considering factors such as indebtedness, strategic investments and resilience in the face of crises, guaranteeing that the needs of the population are met in a responsible and sustainable manner (Hezri & Dovers, 2006). Economic sustainability in public administration consists of the ability to promote local development in a balanced and financially viable way, integrating economic, social and environmental objectives. This is achieved by implementing policies that encourage the green economy, such as support for local commerce, partnerships with the business sector, tax incentives for sustainable practices, the adoption of ecological criteria in public procurement and investment in green jobs. These measures not only boost economic activity, but also ensure the financial

resilience of communities, contributing to fairer and more sustainable development (Wang et al., 2012).

In the context of public administration, environmental sustainability consists of incorporating practices that protect the environment into government policies and operations, promoting collaboration between different levels of government and sectors. In this way, it seeks to meet current needs without compromising future generations, through governance mechanisms that encourage environmental responsibility and the efficient management of natural resources (Yi et al., 2018). In addition, it can encompass factors such as guaranteeing human health and well-being, ensuring clean air and water, adequate sanitation, safe access to drinking water and protection from harmful substances, as well as preserving the vitality of ecosystems, protecting habitats, maintaining biodiversity and controlling the factors that affect air and water quality. It also involves the efficient use of resources, optimizing the use of energy, water and materials to minimize environmental impacts (Fiorino, 2010). Thus, in this area of public administration, environmental sustainability represents the implementation of all strategies that avoid, correct or mitigate environmental impacts, policies, incentives, programs and regulations used by local government to protect, preserve and sustain the natural environment (Laurian et al., 2016).

Finally, we address social sustainability, which promotes human rights, equality, health and education, fostering social cohesion and stability (Sharafizad et al., 2022). Environmental health directly affects social sustainability, as climate change and pollution impact human well-being. Thus, we see that sustainable development requires cooperation to ensure that basic human needs, such as food, housing and education, are met, ultimately supporting economic and social stability (Moldan et al., 2012). The economy depends on environmental sustainability, emphasizing the interconnected nature of the three dimensions of sustainability (Purvis et al., 2019).

In public administration, social sustainability presupposes the promotion of equity, justice and citizen participation, essential elements for the cohesion and legitimacy of government systems. Although normative values such as human rights and political freedoms are fundamental, they alone do not guarantee effective governance. It is necessary to broaden this definition to include robust pillars of governance, such as the rule of law, central management systems, low levels of corruption, security, stability and the realization of political and civil liberties. In this way, social sustainability encompasses both the creation of a fair and inclusive social environment and the establishment of political structures capable of ensuring transparent and efficient administration, capable of facing contemporary challenges and promoting sustainable development (Fiorino, 2010). That said, social sustainability in public administration ensures that everyone has equal access to the benefits of public investment and can meet their basic needs, without any group being exposed to greater environmental damage or having less access to resources. Equity and social justice are thus the fundamental pillars of this approach (Opp, 2016).

2.3. Impact of digitalization in Rural/Urban realities

That said, after analyzing the two main concepts of this study, we will also discuss the impact that digitalization can have on different types of territories.

Digitalization has been associated with regional development, raising social, economic, and environmental standards (Guzhavina, 2021), while reducing global disparities through improved communication and accessibility (Bhutani & Paliwal, 2015). This increases regional

adaptability to technological advances, improving urban infrastructure and attracting investment, thus addressing challenges such as desertification, population aging and income inequality (Guzhavina, 2021; Rodrigues & Franco, 2021). In addition to these elements, it could also have an impact on better urban planning and building design, making cities smarter and improving connectivity to maximize efficiency and ensure that resources are used efficiently (Balogun et al., 2020). In this way, we see the potential of digitalization to impact socioeconomic communities and even environmental dynamics, using IT tools and innovative high-tech concepts.

That said, and after studying the main concepts of this study, we designed the following research questions to guide this work.

Research Question 1: Are there differences in the implementation of digitalization to promote sustainability between urban and rural territories?

At this point, we want to know what are the main policy measures that are being implemented within each territory so that we can understand whether digitalization is rooted in local public policy or not and, if so, in what way and in which areas it is being developed. In this sense, we will also make a comparison between an urban and a rural reality, to understand if there are any significant differences between them. To this end, we will verify the state of evolution of digitalization strategies, either through the score given in the questionnaire or through the testimony of representatives of intermunicipal communities (CIM) given through an interview.
Research Question 2: What are the main challenges in implementing digitalization in the different territories?

In addition to the strategy of each CIM, we also want to find out what obstacles these intermunicipal communities may face about the digitalization implementation process. To this end, we formulated an open question in the interviews so that each CIM could describe their situation and expose any difficulties they may have faced in this process.

3. Methodology

In this study, our main objective is to understand whether there might be differences between urban and rural territories when it comes to implementing digitalization to promote sustainability, be it environmental, economic or social. To guide this research, we have formulated two research questions.

To answer these questions, we identified several dimensions in the literature (table 1 attached) that make up a smart city, this concept being linked to the integration of intelligence in the urban context. This concept highlights the role of technologies in the evolution of cities and identifies key areas, such as infrastructure and services, that need improvement. Thus, a smart city is one that develops and manages a variety of innovative services, providing interactive and comprehensive information on all aspects of urban life through Internet based applications (Lee and Lee, 2014).

Once the dimensions to be studied had been identified, we carried out two types of research. Firstly, we took a qualitative approach by conducting two interviews with a representative from each of the two intermunicipal communities selected, both located in the north of Portugal, one in a rural context and the other in an urban context. Qualitative research is a method that works with non-numerical data, focusing on understanding and exploring phenomena rather than

manipulating variables. It is interpretive and contextualized, prioritizing processes and patterns of development. This method is used to analyze, for example, interviews, field notes and observations (Nassaji, 2020). In these questionnaires we used a Likert scale, with a score from 1 to 5, 1 being very little implemented and 5 being fully implemented, with an additional possibility, *Don't know/Doesn't answer.* At the same time, we carried out quantitative research in the form of questionnaires, which will be a complement to the interviews carried out by each of the representatives of the two CIMs selected for this study. Quantitative research involves collecting structured or closed data, typically in the form of numbers, and analyzing this numerical data to answer research questions and test hypotheses (Guetterman, 2019).

The aim of this methodology is to analyze two different realities and find out whether, due to the typology and characteristics of the territories, there are significant differences in the process of implementing digitalization. At this point, it is important to find out what criteria differentiate a rural or urban area.

Thus, according to the Instituto Nacional de Estatística (2014) an area is urban when:
1) it is typified as *urban land*, according to the planning criteria of the Municipal Spatial Plans.
2) it is part of a section with a population density of more than 500 inhabitants per km².
3) includes a place with a resident population of 5,000 or more.

Predominantly rural areas:
Statistical subsection is categorized as *non-urban land*, in accordance with the planning criteria assumed in the Municipal Land Management Plans, which meet all the following requirements:
1) it has not previously been included in the urban space category.
2) it has a population density equal to or less than 100 inhabitants per km².
3) it is not part of a place with a resident population of 2,000 or more (Instituto Nacional de Estatística website, consulted on 12/02/2025).

That said, our sample will include two Portuguese Intermunicipal Communities (CIM). In this case, we will include an urban CIM, which is predominantly urban, and other rural. The first CIM comprises 11 municipalities and the second CIM is made up of 6 municipalities.
After identifying the most important dimensions in literature (table 1), questions were collected to serve as the basis for the questionnaires, which will be directed at the selected intermunicipal communities.

Before directing these interviews and questionnaires to our target audience, we decided to consult two experts, one from the field of technology and the other from the field of sustainability, so that they could check the rigor and relevance of the questions formulated. We ask them to not only fill in the questionnaire and answer the questions from the interviews, but also to analyze the depth and suitability of the information, so at the end of the process we received a small report from each of the experts, which allowed us to make a deeper reflection about the content and proceed with some changes. The contributions were mainly related to the revision of some technical terms and the change of some expressions, to be clearer and more understandable, particularly to the residents. So, we made some adjustments to the wording so that it was technically clear, and everyone could understand the questions more easily. The most important suggestion was related to the health section, since one of the experts explained that these issues were not part of the municipalities' delegations and responsibilities and suggested elimination of it. After going back to some technical reports, we decided to follow the expert's suggestion and remove the health sub-dimension from our tools. These Questionnaires have a

score between 1 and 5, with 1 not being implemented and 5 being fully implemented, with the possibility of *Don't know/ Doesn't answer*.
After finalizing the questionnaires (table 1) and the interviews (table 2 attached), we moved on to the data collection process and the questionnaires addressed to the intermunicipal communities were sent by email and completed via Google Forms while the interviews were conducted via video call.

4. Results and Discussion

After collecting the data from interviews and questionnaires, an analysis will be conducted based on the 10 sub-dimensions of the questionnaire (Table 1). Each theme will be addressed individually, with a comparative approach between the Intermunicipal Communities (CIMs), specifically contrasting urban and rural realities.

In the *Institutional Support for Economic Development* dimension, the rural CIM rated both entrepreneurship promotion and regional product promotion with a score of 5, but selected *Don't Know/Doesn't Answer* for the remaining three variables. The urban CIM presented a more balanced evaluation, scoring 4 across entrepreneurship promotion, regional products, employment promotion, technological innovation, and 2 for interactive consultancy services. This suggests a more structured and comprehensive approach in the urban CIM, while the rural CIM tends to focus on traditional areas but shows gaps in innovation and digital support for entrepreneurship. Interview findings revealed that in the rural CIM, there is a weak coordination between the CIM and other entities, which has hindered the advancement of business support initiatives. Projects such as the creation of digital platforms to promote and sell local products have encountered institutional and bureaucratic barriers, undermining efforts to strengthen the local business fabric, especially in a region that lacks effective solutions to stimulate economic activity. In contrast, the urban CIM has several projects focused on business digitalization, with action plans already in place, particularly in industry. Digitalization is seen as a strategic, cross-cutting priority, supporting sectors such as footwear, textiles, wood, furniture, and metalworking, key components of the local economy. The actions aim to enhance business capacities by promoting the adoption of technologies in production processes.

In the *Energy Saving* dimension, the rural CIM rated policies related to energy saving in public lighting with a 5, leaving the other two variables unanswered. The urban CIM scored 5 in both renewable energy promotion and energy saving, and 3 in digital awareness initiatives. According to interviews, the rural CIM has already implemented certain measures for energy saving, such as the installation of LED lighting and biomass-related initiatives, though these remain relatively superficial. Meanwhile, the urban CIM is progressing in areas such as renewable energy and smart lighting, although these are still in early stages. Nonetheless, there are plans to invest in both material assets and intelligent information systems using available financial instruments.

In the *Environmental Technology/ICT* dimension, the rural CIM answered *Don't Know/Doesn't Answer* for all questions. The urban CIM, however, rated 4 for its use of technology to reduce environmental impact and 2 for the monitoring of environmental indicators. Despite modest scores, only the urban CIM demonstrates identifiable actions. Interviews indicate that while progress in the rural CIM remains limited, some steps have been taken, such as the acquisition of an electric vehicle and a biomass energy pilot project. In contrast, the urban CIM is implementing digitalization initiatives focused on mobility. It has acquired monitoring systems

for public transport services and is planning further investment in renewable energy and smart lighting, again supported by financial instruments.

In the *Waste Management and Water Resources* dimension, the rural CIM did not answer any of the questions. The urban CIM scored 2 for water quality control, 2 for waste reduction, 3 for waste monitoring using sensors, and 4 for recycling promotion through digital education. Despite average scores, only the urban area shows notable progress in this dimension. Interview data reveal that the rural CIM is planning future developments in this field with the support of European funding, while the urban CIM noted planned investments aligned with the national smart territory strategy.

In the *Governance* dimension, the rural CIM rated transparency promotion, accessibility of online services, and digital channels for citizen engagement all with 4. The urban CIM scored 5 across all variables, reflecting a more consolidated approach to digital governance. Both CIMs reported progress in providing administrative services online, offering free public Wi-Fi, and promoting transparency through municipal websites. Interviews highlighted ongoing efforts to ensure that the entire population can access digital tools. Some gaps remain in the rural CIM, while the urban CIM has implemented several initiatives to increase digital literacy, especially among disadvantaged citizens.

In the *Availability of Technology/ICT* dimension, the rural CIM gave a score of 4 to public Wi-Fi availability, electronic boards, and inclusive digital strategies. The urban CIM rated 3 for Wi-Fi, 3 for digital boards, and 5 for digital inclusion. Both CIMs show a good level of implementation, though the rural CIM displays greater consistency. Interview responses suggest that while the rural CIM has limited technological equipment, some elements, such as interactive displays in tourist offices, have been introduced. However, the region is still in an early implementation phase, and actual availability of electronic boards is low despite the high questionnaire scores. In the urban CIM, some technological elements are already in place, but European funding was highlighted as essential for further development. Existing gaps were acknowledged, and it was noted that there is still a long road ahead.

In the *Tourism* sector, questionnaires revealed that both CIMs are committed to developing this area. The urban CIM stands out slightly, with scores of 4 and 5, whereas the rural CIM gave a score of 4 to some actions and answered *Don't Know/Doesn't Answer* for others, indicating more limited investment in certain initiatives, such as the promotion of cultural assets on municipal websites and tourism apps. Interviews show that the rural CIM has implemented specific technological initiatives, such as an interactive tourist office where visitors can access regional information via digital tables, and QR codes on historical monuments, allowing access to detailed content via mobile devices. These reflect efforts to innovate and enhance cultural heritage. In contrast, the urban CIM integrates digitalization into broader policies without a dedicated strategy for tourism. Here, digital initiatives are tied to economic development, climate action, and public service management. Nonetheless, officials acknowledge shortcomings in digital tourism promotion and recognize the need for additional investment to address existing gaps.

In the *Security* dimension, the rural CIM did not answer any of the three questionnaire variables. The urban CIM rated 2 for alert systems, 2 for protection plans, and 3 for CCTV, suggesting a degree of technological coverage, albeit with room for improvement. Interview insights show that the rural CIM is investing in a cybersecurity project and in the installation of surveillance systems for monitoring public spaces. Meanwhile, although the urban CIM also has digital

safety measures in place, its representatives noted these are still insufficient, highlighting the need for further development. Therefore, while the urban CIM scored higher in the questionnaire, the rural CIM shows tangible efforts to enhance digital security.

For the *Mobility and Transport* dimension, the rural CIM is still in an initial phase, responding with *Don't Know/Doesn't Answer* for all variables, likely reflecting the absence of digital initiatives such as traffic monitoring, smart bus stops, and apps for non-polluting transport. The urban CIM, on the other hand, scored 4 for both traffic monitoring and smart stops, and 3 for alternative transport apps, indicating progress in this area. According to interviews, the rural CIM has introduced isolated measures, such as a real-time monitoring platform for public transport using GPS on buses to improve service control. However, public access to this information remains limited, consistent with the low scores for digital monitoring and smart stops. In the urban CIM, similar efforts include the implementation of electronic panels and real-time monitoring systems. Yet, despite investments, significant challenges remain, especially in making information more accessible. Thus, the comparison reveals that while both rural and urban CIMs are making efforts to digitize transport, they continue to face obstacles related to accessibility and real-time information availability.

In the *Social Capital* dimension, the rural CIM answered *Don't Know/Doesn't Answer* for all variables. The urban CIM scored 4 for digital professional training services, 4 for digital literacy programs, and 5 for prioritizing education and innovation in the political agenda. This dimension clearly highlights the urban CIM's advantage in investing in digital capacity-building and inclusion. Interviews revealed that the rural CIM has made some efforts, such as offering a postgraduate course in Digital Transformation, but only for CIM staff, limiting the reach of such actions to the wider population. In contrast, the urban CIM has been integrating digitalization into programs aimed at reducing inequality, enhancing digital skills among administrative workers, and supporting vulnerable groups, such as the elderly.

The analysis of the collected data reveals that rural and urban territories display different levels of digital maturity and strategic approach. In rural areas, there is still no collective digitalization strategy, although there are sector-specific initiatives integrated into programs like Norte 2030, particularly in mobility, education, and tourism. However, significant gaps remain in areas such as transport and environmental management. In contrast, urban territories demonstrate a more consolidated and cross-sector approach to digitalization, with a strong focus on economic competitiveness and sustainability, though technological implementation challenges persist. Despite their differences, both territories show a commitment to administrative modernization, transparency, and access to digital services, reflecting a shared effort towards sustainable development.

Research Question 2: What are the main challenges in the process of implementing digitalization in different territories?

About rural CIM, through the testimony collected in the interviews, the main challenges and barriers identified in the process of digitalizing the rural intermunicipal community are mainly related to resistance to change on the part of people, especially older staff. Adapting to digitalization, such as implementing a document management system, is a significant challenge, as many employees have difficulty working without the use of paper. This obstacle is even more present due to the predominance of an aging population in the region, which aggravates resistance to the digital transition both within the CIM and among citizens. Furthermore, it was pointed out that bureaucratic issues and the lack of resources to implement technological

changes make it difficult to advance initiatives that could drive digitalization more effectively. An example of this is the proposal to create an online platform for the marketing of local agricultural products, such as wine, olive oil and chestnuts, which has not yet been implemented due to administrative issues.

About urban CIM, the main barriers identified in the process of implementing digitalization are related to the diversity of realities between municipalities, which makes it difficult to uniformly apply intermunicipal action plans. The variation in the level of development of municipalities, both in the public and private sectors, generates different perceptions and resistance, which makes the adoption of digitalization processes difficult. Furthermore, the lack of digital maturity in certain social groups, such as elderly people with low levels of digital literacy, represents a major obstacle. Another significant challenge highlighted, more specifically in the agricultural sector, is the difficulty in engaging small farmers, especially due to their high average age and resistance to adopting advanced technologies, such as precision agriculture. These disparities require a more personalized and strategic approach for digitalization to be effectively adopted across all sectors of the community.

5. Conclusion

Analyzing the data collected, digitalization is considered essential for promoting sustainability, but the answers to the research questions reveal that urban and rural contexts present very different approaches and challenges. In rural CIM, digital initiatives are predominantly specific and targeted at specific sectors, such as tourism and local entrepreneurship, reflecting the absence of a collective and integrated strategy that expands the scope of technological benefits. This reality is compounded by significant challenges, such as resistance to change, particularly among older employees, bureaucratic obstacles and a lack of resources that make it difficult to implement and develop new digital solutions for the territory.

In contrast, in urban CIM, digitalization is incorporated transversally into several public policies, covering areas such as climate action, public service management and social inclusion. However, this integration faces barriers arising from the heterogeneity between municipalities and insufficient digital literacy in certain groups, which prevents uniform and effective adoption of technologies. Thus, this analysis shows that, although the consensus on the importance of digitalization is unanimous, each territory needs policies and strategies adapted to its own characteristics to maximize the benefits and overcome the limitations inherent to its reality. The dependence of these local organizations on central power ends up imposing some rules and limits, particularly in the financial field. Despite belonging to the same country and governed by the same state, these bodies are dependent on endogenous factors, namely the capacity of their human resources, the defined strategy, local realities and expectations of the local population.

The theoretical implications of this study deepen the understanding of the relationship between digitalization and sustainability in different territorial contexts. By analyzing the strategies adopted by CIM and the challenges in implementing digital transformation, the study contributes to the discovery of new perspectives on how digitalization influences sustainable development. The results can also identify critical factors for the success of digitalization, allowing the formulation of more robust theories about the impact of digitalization in urban and rural territories.

As part of the practical implications, the study provides recommendations for public managers, companies and policy makers on how to optimize digitalization to promote sustainable development in regions with certain particularities. CIM analysis helps identify good practices and challenges that can serve as a reference for other regions in implementing effective digital policies. In this way, the study aims to generate concrete impacts on the formulation of public policies and on strengthening digitalization as a sustainability tool.

Regarding limitations, this study has a restricted geographic scope, variation in the strategies adopted and lack of analysis of long-term impacts. For future research, it is suggested to expand the geographic scope, carry out studies that consider new external factors such as policies, culture and behavior in digital adoption to explain the variation between regions, as well as carry out a temporal analysis and evaluate the evolution process of the respective territories as well as evaluate which areas experienced more changes and whether there was the implementation of more and new technologies in the territories under study.

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REFERENCES

Balogun, A. L., Marks, D., Sharma, R., Shekhar, H., Balmes, C., Maheng, D., Arshad, A., & Salehi, P. (2020): ***Assessing the Potentials of Digitalization as a Tool for Climate Change Adaptation and Sustainable Development in Urban Centres***. Sustainable Cities and Society, 53, 101888.

Bhutani, S., & Paliwal, Y. (2015): ***Digitalization: A step towards sustainable development***. OIDA International Journal of Sustainable Development, 8(12), 11-24.

Brennen, J. S., & Kreiss, D. (2016): ***Digitalization***. The international encyclopedia of communication theory and philosophy, 1-11.

Brenner, B., & Hartl, B. (2021): ***The perceived relationship between digitalization and ecological, economic, and social sustainability***. Journal of Cleaner Production, 315, 128128.

Dale, B. (2002): ***An Institutionalist Approach to Local Restructuring***. European Urban and Regional Studies, 9(1), 5–20.

Di Giulio, M., & Vecchi, G. (2023): ***Implementing digitalization in the public sector***. Technologies, agency, and governance. *Public Policy and Administration*, *38*(2), 133-158.

El Sawy, O. A., Kræmmergaard, P., Amsinck, H., and Vinther, A. L. (2016): ***"How LEGO Built the Foundations and Enterprise Capabilities for Digital Leadership***.," MIS Quarterly Executive (15:2), pp. 141–166.

Fiorino, D. J. (2010): ***Sustainability as a Conceptual Focus for Public Administration***. Public Administration Review, 70, s78–s88.

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016): ***A review on circular economy: The expected transition to a balanced interaction of environmental and economic systems***. Journal of Cleaner Production. 114, 11-32.

Gibberd, J. (2015): ***Measuring capability for sustainability: the built environment sustainability tool (BEST).*** Building Research & Information, 43(1), 49-61.

Gradillas, M. & Thomas, L. D. (2023): ***Distinguishing digitization and digitalization: A systematic review and conceptual framework***. Journal of Product Innovation Management.

Greenwood, R., Hinings, C. R., & Whetten, D. (2014): ***Rethinking institutions and organizations***. Journal of management studies, 51(7), 1206-1220.

Guetterman, T. C. (2019): ***Basics of statistics for primary care research.*** Family medicine and community health, 7(2), e000067.

Guzhavina, T. A. (2021): ***Digitalization for sustainable development of small towns in Russia***. European Journal of Sustainable Development, 10(1), 401-401.

Hezri, A. A., & Dovers, S. R. (2006): ***Sustainability indicators, policy and governance: Issues for ecological economics***. Ecological economics, 60(1), 86-99.

Instituto Nacional de Estatística. (2014): ***Tipologia de Áreas Urbanas 2014: Relatório Técnico***. Retrieved February 12, 2025 from https://smi.ine.pt/Versao/Download/10129.

Isensee, C., Teuteberg, F., Griese, K. M., & Topi, C. (2020): ***The relationship between organizational culture, sustainability, and digitalization in SMEs: A systematic review***. Journal of Cleaner Production, 275, 122944.

Laurian, L., Walker, M., & Crawford, J. (2016): ***Implementing Environmental Sustainability in Local Government: The Impacts of Framing, Agency Culture, and Structure in US Cities and Counties***. International Journal of Public Administration, 40(3), 270–283.

Lee, J., & Lee, H. (2014): ***Developing and validating a citizen-centric typology for smart city services***. Government Information Quarterly, 31, S93-S105.

Moldan, B., Janoušková, S., & Hák, T. (2012): ***How to understand and measure environmental sustainability: Indicators and targets***. Ecological Indicators, 17, 4–13.

Mondejar M.E., Avtar R., Diaz H.L.B., Dubey R.K., Esteban J., Gómez-Morales A., Hallam B., Mbungu N.T., Okolo C.C., Prasad K.A., She Q., & Garcia-Segura, S. (2021): ***Digitizing to Achieve Sustainable Development Goals: Steps to a Smart Green Planet***. Science of the Total Environment, 794.

Nassaji, H. (2020): ***Good qualitative research***. Language Teaching Research, 24(4), 427-431.

Opp, S. M. (2016): ***The forgotten pillar: a definition for the measurement of social sustainability in American cities***. Local Environment, 22(3), 286–305.

Purvis, B., Mao, Y., & Robinson, D. (2019): ***Three pillars of sustainability: in search of conceptual origins***. Sustainability science, 14, 681-695.

Rodrigues, M., & Franco, M. (2021): ***Digital entrepreneurship in local government: Case study in Municipality of Fundão, Portugal***. Sustainable Cities and Society, 73, 103115.

Sharafizad, J., Redmond, J., & Parker, C. (2022): ***The influence of local embeddedness on the economic, social, and environmental sustainability practices of regional small firms***. Entrepreneurship & Regional Development, 34(1-2), 57-81.

Tat-Kei Ho, A. (2002): ***Reinventing Local Governments and the E-Government Initiative.*** Public Administration Review, 62(4), 434–444.

Wang, X., Hawkins, C. V., Lebredo, N., & Berman, E. M. (2012): ***Capacity to Sustain Sustainability: A Study of U.S. Cities***. Public Administration Review, 72(6), 841–853.

Yi, H., Suo, L., Shen, R., Zhang, J., Ramaswami, A., & Feiock, R. C. (2017): ***Regional Governance and Institutional Collective Action for Environmental Sustainability***. Public Administration Review, 78(4), 556–566.

Annex

Table 1: Questionnaire

Dimension	Sub-Dimension	Question	Bibliographic Support
Smart Economy	Institutional Support for Economic Development	1.1 Entrepreneurship Promotion	Charalabidis et al. (2018); Ji et al. (2021); Siokas et al. (2021); Alizadeh & Sharifi (2023)
		1.2 Local Products Promotion	Charalabidis et al. (2018); Ji et al. (2021); Siokas et al. (2021)
		1.3 Employment Initiatives	Charalabidis et al. (2018); Ji et al. (2021); Siokas et al. (2021)
		1.4 Technological Innovation Promotion	Charalabidis et al. (2018); Ji et al. (2021); Siokas et al. (2021); Alizadeh & Sharifi (2023)
		1.5 Youth Consulting Services	Charalabidis et al. (2018); Ji et al. (2021); Siokas et al. (2021); Alizadeh & Sharifi (2023)
Smart Environment	Energy Saving	2.1 Renewable Energy Tech	Charalabidis et al. (2018); Ji et al. (2021)
		2.2 Efficient Public Lighting	Charalabidis et al. (2018); Ji et al. (2021); Siokas et al. (2021); Alizadeh & Sharifi (2023)
		2.3 Digital Energy Awareness	Charalabidis et al. (2018); Ji et al. (2021)
	Environmental Technology/ICT	3.1 Digital Environmental Strategy	Own elaboration
		3.2 Technological Environmental Monitoring	Charalabidis et al. (2018); Ji et al. (2021); Siokas et al. (2021)
	Waste management and water resources	4.1 Online Water Quality	Charalabidis et al. (2018); Ji et al. (2021)
		4.2 Water Leak Monitoring	Charalabidis et al. (2018); Ji et al. (2021); Siokas et al. (2021)
		4.3 Digital Waste Management	Charalabidis et al. (2018); Ji et al. (2021)
		4.4 Recycling Tele-education	Charalabidis et al. (2018); Ji et al. (2021)
Smart Governance	Governance	5.1 Digital Transparency	Charalabidis et al. (2018); Ji et al. (2021); Siokas et al. (2021)
		5.2 Online Service Accessibility	Charalabidis et al. (2018); Ji et al. (2021); Siokas et al. (2021); Alizadeh & Sharifi (2023)
		5.3 Citizen Feedback Channel	Charalabidis et al. (2018); Ji et al. (2021); Siokas et al. (2021)
	Availability of Technology/ICT	6.1 Free Public Wi-Fi	Charalabidis et al. (2018)
		6.2 Dynamic Info Boards	Charalabidis et al. (2018); Ji et al. (2021)

Smart living		6.3 Inclusive Digital Strategy	Own elaboration
	Tourism	7.1 Digital Tour Guide	Charalabidis et al. (2018)
		7.2 Tourism Mobile Apps	Charalabidis et al. (2018)
		7.3 Digital Cultural Promotion	Charalabidis et al. (2018); Ji et al. (2021)
	Security	8.1 Early Alert Systems	Charalabidis et al. (2018)
		8.2 Emergency Response Plans	Charalabidis et al. (2018)
		8.3 Real-Time Surveillance	Ji et al. (2021); Alizadeh & Sharifi (2023)
Smart Mobility	Transport/Mobility	9.1 Digital Traffic Monitoring	Charalabidis et al. (2018); Ji et al. (2021)
		9.2 Smart Bus Stops	Charalabidis et al. (2018); Ji et al. (2021)
		9.3 Soft Mobility Apps	Charalabidis et al. (2018); Ji et al. (2021)
Smart People	Social Capital	10.1 Online Professional Education	Siokas et al. (2021); Ji et al. (2021); Alizadeh & Sharifi (2023)
		10.2 Digital Skills Training	Siokas et al. (2021); Ji et al. (2021); Alizadeh & Sharifi (2023)
		10.3 Education & Innovation Priority	Siokas et al. (2021); Ji et al. (2021)

Source: Authors

Table 2: Open-ended questions

Open-ended questions	1. Is there a collective strategy to promote digitalization in the municipalities that make up the Intermunicipal Community? If so, when did the implementation of this strategy begin and what progress has been made?
	2. What were the main challenges/barriers faced during the process of implementing digitalization in the different sectors within the intermunicipal community? Are there also some discrepancies in the implementation of strategies between urban and rural territories?
	3. What are the efforts of the intermunicipal community to promote, through digitalization, actions for the development of citizens' skills and innovation, to promote social inclusion and reduce digital disparities between different social groups?
	4. How important is digitalization for the economic sustainability of the intermunicipal community, especially about job creation, growth of local businesses and valorization of the territory (through the promotion of cultural and historical elements)?
	5. Is the topic of digitalization included in green technology projects or initiatives to promote more sustainable practices and reduce the environmental impact in the intermunicipal community? That is, by encouraging the use of soft mobility, the use of renewable energy resources, smart lighting, etc.
	6. In addition to the elements in the questionnaire, have other measures been taken to promote sustainability based on digitalization?
	7. What are the next steps in terms of digital public policies that the intermunicipal community intends to implement to further strengthen its economic competitiveness, social cohesion and environmental resilience?

Source: Authors

A scientific paper

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GEOGRAPHIC CONCENTRATION, SPECIALIZATION AND REGIONAL DISPARITIES IN CROATIA

ABSTRACT

This paper analyses the relationship between geographic concentration, regional specialization and regional disparities in Croatia between 2000 and 2019. Although concentration and specialization are related phenomena and often move together, divergent movements are possible. Geographic concentration and regional specialization are measured using the Herfindahl-Hirschman (HH) index, while regional disparities are measured using the coefficient of variation. The Herfindahl-Hirschman concentration and specialization indices are calculated based on value added data, while regional disparities are measured based on GDP per capita data. The analysis is based on the assumption that the growing gap between concentration and specialization is positively correlated with increasing regional disparities. This means that economic activities are concentrated in certain regions while the average specialization of regions is decreasing or growing more slowly. In other words, if geographic concentration grows faster than specialization, regional development may become uneven and regional disparities may increase. The results of the analysis in this paper confirm this hypothesis using the Pearson correlation coefficient, which shows a strong and positive relationship between the growing concentration-specialization gap and regional disparities. However, the positive correlation is not constant throughout the observed period. After 2014 stagnation of the concentration-specialization gap was recorded, while regional disparities decreased. At that time, Croatia was already a member of the European Union and began to use European Structural and Investment Funds more intensively, which is a possible explanation for the trend of decreasing regional disparities despite the stagnation of the concentration/specialization gap.

Key words: *Geographic concentration, regional specialization, regional disparities in Croatia.*

1. Introduction

Geographic concentration and regional specialization are related but distinct economic phenomena. Geographic concentration refers to the clustering of economic activities in space and usually arises as a result of agglomeration economies. These are advantages of proximity because they use the size of the market with many consumers and suppliers, a qualified workforce and easier knowledge spillover. The most famous example of agglomeration economies, or rather localization economies, is Silicon Valley in the USA where a dense network of high-tech companies such as Meta, Google, Nvidia, Intel, etc. is observed. Detroit, as a major stronghold of the American automotive industry, is also an example of agglomeration economies which is now in decline. Regional specialization examines whether the share of a region (or location) in the industry is relatively higher compared to the shares of

other regions (or locations). The examination of regional specialization aims to determine the economic structure of the region. Therefore, the distribution of sectoral shares in the regional economy is observed and compared with the rest of the country. A region is highly specialized if a small number of industries have a large (combined) share in the economy of that region. A historical example is the German Ruhr, which represents a concentration of heavy industry. In Italy, Tuscany is an example of a concentration of high fashion and leather production. Although there is an overlap between the concepts of concentration and specialization, they are not mutually exclusive. A region that specializes in a particular industry may also have a high concentration of that industry (for example, the film industry in Hollywood). On the other hand, an area may have a high concentration of industry, but at the same time not be specialized in a specific activity (any large metropolitan area in which there are many industries).

For a long time, specialization and concentration were considered closely related phenomena, often even synonymous. Models and empirical analyses of regional specialization and industrial concentration largely stem from trade theory and location theory, emphasizing the spatial dimension of economic activities. Trade, as an exchange process, is influenced by spatial factors, while the spatial distribution of economic activity shapes trade patterns within and between countries. At the same time, trade enables firms in certain regions to specialize in the production of specific goods. At a theoretical level, the relationship between concentration and specialization depends on the particular theoretical perspective, while in empirical analyses, both phenomena are often measured using the same indicators. The conceptual connection between these processes is based on the idea that trade and location are “two sides of the same coin” (Isard, 1956, p. 207). As early as the 1930s, Ohlin (1933) pointed out that international trade theory is actually a subset of the broader theory of localization. However, a true synthesis of these two theories has recently emerged within the framework of "New Economic Geography," which integrates key elements of trade theory into a theory of spatial location, including externalities and imperfect competition. According to this perspective, large markets offer various advantages to firms, leading industries with economies of scale to concentrate in a limited number of regions. Krugman (1991b) demonstrates that falling trade/transportation costs can result in a core-periphery structure, where firms agglomerate in dominant regions, thereby fostering regional specialization. This distinction between trade theory and location theory highlights that geographic concentration and regional specialization are not identical concepts and may manifest differently. Specialization is rooted in Ricardo’s theory of comparative advantage and the Heckscher-Ohlin theory of international trade. According to Ricardo, a country should specialize in the production of goods it can produce relatively more efficiently and import those it produces less efficiently, meaning that comparative advantages shape the country's production structure. In contrast, the Heckscher-Ohlin theory posits that a country specializes in producing goods that intensively use its relatively abundant factors of production. For example, a capital-rich country is expected to specialize in capital-intensive goods and import labor-intensive ones. Because trade influences relative prices, it also has a substantial impact on income distribution by altering the returns to factors of production (Krugman and Obstfeld, 2009).

Geographic concentration and specialization can be observed in the context of regional disparities. Regions with a high concentration of industry tend to grow faster than those regions where this does not happen. Agglomeration economies attract investment, new firms, skilled workforce, leaving less developed regions—lacking specialization and agglomeration economies—even further behind. On the other hand, highly specialized regions may be more vulnerable to external shocks. Economic policy should then work towards greater industrial

diversification by strengthening infrastructure (digital and transport), establishing innovation hubs and offering tax breaks for companies and residents.

This paper analyses geographic concentration and regional specialization and their relationship with regional disparities in Croatia. Specifically, it investigates the concentration/specialization gap and links it to trends in regional disparities. This suggests that economic activity is becoming more concentrated in certain regions, while others experience slower specialization, hindering their development and ultimately exacerbating regional inequalities. In other words, if economic concentration grows faster than specialization, regional development may become increasingly uneven, deepening economic disparities within the country. There is a lack of empirical research that examines the relationship between geographic concentration, regional specialization, and the evolution of regional disparities, particularly in the context of Croatia. Most existing studies address these concepts separately. This paper represents a step forward by integrating them into a unified analytical framework, with a specific focus on Croatia. To measure concentration and specialization, the study employs the Herfindahl-Hirschman (HH) Index, using gross value added (GVA) data by industry and county. Meanwhile, regional economic disparities are assessed using the coefficient of variation, calculated based on county GDP per capita. The analysis is conducted for the period 2000-2019. While data for later years exist, they are excluded due to significant disruptions from exogenous shocks (e.g., COVID-19, the Ukraine war), which distort standard economic patterns. The COVID-19 pandemic sharply but briefly impacted Croatia's economy, whereas the Ukraine war triggered persistent supply-chain and energy-security disruptions. Inclusion of this period would distort results and obscure long-term trends in concentration, specialization, and regional disparities.

The paper is structured as follows. After the introduction, the second section provides the theoretical background and a review of relevant literature. The third section outlines the data and methodology in detail, followed by an analysis of geographic concentration, specialization, and their relationship with regional inequalities. The fourth section discusses key findings and concluding remarks and offers policy recommendations.

2. Theoretical background and literature review

2.1. Theoretical background

The connection between geographic concentration, regional specialization, and growing regional disparities can be understood through several theoretical frameworks: 1) agglomeration-based theories such as New Economic Geography (NEG) and core-periphery models; 2) structural change and inequality dynamics, as articulated in Williamson stage theory; and 3) the concepts of resilience and the export base model. A widening gap between concentration and specialization suggests that economic activity increasingly clusters in developed regions, while lagging regions struggle to establish strong specialization, ultimately exacerbating regional disparities.

1) From the perspective of agglomeration based theories, New Economic Geography (Krugman, 1991a; Fujita et al., 1999) explains spatial concentration as a result of agglomeration economies. Firms cluster to access a skilled workforce, benefit from knowledge spillovers and shared infrastructure, adopt new technologies more easily, and boost productivity, further attracting investment. Meanwhile, core-periphery theory highlights how core regions, with their diversified industrial bases, draw in capital, talent, and

innovation, reinforcing their dominance over peripheral areas. In contrast, peripheral regions have narrower specialization, are less competitive, and become dependent on external growth factors (Krugman, 1991b).

2) The stage theory of regional inequalities, particularly the Kuznets hypothesis (Kuznets, 1955; Williamson, 1965), suggests that regional disparities rise during early stages of industrialization but decline over time. However, if economic concentration in certain regions continues to increase without corresponding specialization in other regions, regional disparities are more likely to persist or even grow rather than decline. In Croatia, amid the post-transition economic transformation, this scenario is highly plausible. The strong concentration of economic activity in and around Zagreb, coupled with the lack of specialization in other regions (particularly in the eastern part) is consistent with the predictions of the Kuznets hypothesis. One way to counteract this trend is through redistribution policies and investments in infrastructure for lagging regions.

3) In the context of resilience and export base model, Martin and Sunley (2015) introduced the concept of economic resilience emphasizing the ability of regions to recover from shocks. This emerging concept is becoming increasingly important for strengthening regional, local, and urban economies. In terms of regional specialization, highly specialized regions may be more vulnerable to economic shocks because their economies rely on a limited number of sectors. If investments and innovations are concentrated in only a few regions, peripheral regions risk stagnation, further widening economic disparities. In the context of Croatia, the counties of Adriatic Croatia are highly specialized in the tourism sector, which places them in a vulnerable position in the event of a negative external shock. According to the export base theory, developed by North (1955) and later expanded by Hirschman (1958), when export industries are concentrated in only a few regions while others remain reliant on traditional non-export sectors (e.g., construction), capital accumulation becomes uneven. Wealthier regions attract more investments, and the diffusion of innovation remains unequal, as new technologies and knowledge fail to spread evenly across all regions. This dynamic further exacerbates regional economic differences, as regions with developed export sectors achieve higher added value and economic growth, while others continue to lag behind.

In sum, the gap between geographic concentration and regional specialization, where concentration increases in developed areas while lagging regions fail to specialize, can significantly contribute to persistent regional disparities. This paper aims to empirically assess this dynamic in Croatia by linking these concepts to regional data on production and GDP p.c.

2.2. Literature review

Given the importance of trade in shaping patterns of concentration and specialization, these phenomena are often analyzed in the context of economic integration. There were concerns that European integration could lead to greater regional specialization, making regions more vulnerable to economic shocks. However, Hallet (2000), analyzing European regions, concluded that their economic structures have become more similar, with a greater emphasis on services, and that there is no evidence of increased industrial concentration. Aiginger (1999) provides a systematic review of existing literature on changes in industrial structure, laying the foundation for examining concentration and specialization patterns. He also offers an overview of absolute and relative indicators used for measurement, highlighting their respective advantages and limitations. Bickenbach and Bode (2008) further extend the methodological framework for measuring concentration and specialization.

Dalum et al. (1998) analyze the export specialization of 20 OECD countries between 1965 and 1992 and find that specialization and concentration can follow different dynamics. Amiti (1999) shows that between 1968 and 1990, specialization increased in Belgium, Denmark,

Germany, Greece, Italy, and the Netherlands, while France, Spain, and the United Kingdom experienced a decline. Additionally, 17 out of 27 industrial sectors saw an increase in geographical concentration. Ezcurra et al. (2006) examine the spatial distribution of industry in the European Union from 1977 to 1999 and conclude that industrial concentration increased during this period. Traistaru et al. (2002b) study the effects of economic integration on regional specialization and the geographical concentration of the manufacturing industry in candidate countries for the European Union's 2004 enlargement. Their findings suggest that a combination of factor endowments and geographical proximity to the European core determines the location of the manufacturing industry in these candidate countries. Aiginger and Leitner (2002) compare the regional concentration of the manufacturing industry in the United States and Europe. They conclude that while concentration is higher in the U.S., it has been declining at a faster rate. In Europe, this trend became particularly evident after the establishment of the single market. Rossi-Hansberg (2005) developed a spatial trade theory, arguing that trade patterns can be explained through concentration and specialization. He also hypothesized that changes in transport costs lead to divergent trends in these two phenomena. This hypothesis was empirically confirmed by Aiginger and Rossi-Hansberg (2006) in their study of the U.S. and the EU. Using the Gini coefficient as a measure of concentration and specialization, they demonstrated that lower transport costs lead to increased specialization but decreased concentration in both the U.S. and the EU. Gervais et al. (2024) examine patterns of concentration and specialization in the U.S. over a 30-year period for industries and a 20-year period for occupations. Their main conclusion is that concentration and specialization in industries have declined, while concentration and specialization in occupations have increased. Notably, these changes are not the result of employment shifts between sectors or occupations with different concentration levels but have instead occurred within industries and occupations themselves. Traistaru et al. (2002a) study the case of Romania and observe a tendency for growth in both absolute and relative regional specialization, as well as an increase in industrial concentration in 7 out of 13 industrial branches. Additionally, they find that regional GDP is becoming more concentrated compared to regional GDP per capita, suggesting a trend toward greater income polarization. A similar conclusion is reached by Goschin et al. (2009), who find that Romanian regions have become less specialized over time while industries have become more concentrated. Cutrini (2009) analyzes industrial location patterns in the European Union during the integration process from 1985 to 2001. He concludes that economic activities have become more dispersed, leading to a reduction in international polarization. Lehocký and Rusnák (2016) examined Slovakia and found that concentration increased in traditional (mature) industries, while regional specialization declined. Sekur (2018) analyzed the period from 1997 to 2008 using data from Croatian counties and concluded that concentration and specialization moved in opposite directions—concentration increased, while specialization decreased. This trend is even more pronounced when employment data is taken into account.
Among studies on concentration and specialization in East Asia, Park (2003) stands out, concluding that East Asian countries are less specialized and concentrated compared to the U.S. and the EU. However, he suggests that further economic integration could strengthen both processes. Long and Zhang (2012) analyze China and find that industrial concentration and regional specialization increased significantly between 1995 and 2004, pointing to the strong development of industrial clusters.

In conclusion, the theoretical and empirical literature suggests that concentration and specialization are not necessarily synonymous and that their dynamics can vary depending on the context. The development of specialization and concentration, influenced by comparative advantages and structural changes, can have different effects on regional economic

distribution. While increased specialization may heighten a region's vulnerability to economic shocks, greater concentration can lead to deeper regional inequalities.

3. Method and data

In this paper, the Herfindahl-Hirschman (HH) index is used to calculate the coefficients of geographic concentration and regional specialization. The index serves as a statistical measure of concentration in various contexts. For example, it can measure the concentration of household income (or wealth) as well as market concentration, i.e., the degree of corporate output concentration in sectors such as banking or industry (Rhoades, 1993). There are also alternative measures such as the Theil Index, the Shannon Entropy Index, or the Gini Index. Palan (2010) compares nine commonly used absolute and relative indices of specialization, analyzing their properties, strengths, and weaknesses, and concludes that the HHI meets the most criteria (among absolute measures) and is easy to compute, which justifies its use in this paper.

In this paper, concentration refers to the share of a particular region (county) in a specific economic activity, effectively measuring the distribution of regional shares in that activity. A high level of concentration means that a significant portion of the activity is located in one or a few regions. Conversely, regional specialization examines the economic structure of a region (county), comparing the distribution of sectoral shares in its economy with the rest of the country. A region is considered highly specialized if a small number of activities dominate its economy. Both geographic concentration and regional specialization are measured using the HH index. As an absolute measure of concentration, the HH index is calculated by summing the squares of a region's share in an activity. A value of 1 indicates complete concentration of activity in a single region, while a value close to 0 signifies high dispersion. Similarly, as an absolute measure of specialization, the HH index is computed as the sum of the squares of an industry's share in a region's economy. A value of 1 indicates complete specialization, whereas a value near 0 suggests high diversification.

Mathematically, the HH concentration/specialization index is defined by Goschin et al. (2009) as:

$$\boldsymbol{H}_j^c = \sum_{i=1}^{n} (\boldsymbol{g}_{ij}^c)^2 \qquad \boldsymbol{H}_i^s = \sum_{j=1}^{m} (\boldsymbol{g}_{ij}^s)^2$$

Where:

$$\boldsymbol{g}_{ij}^c = \frac{\boldsymbol{X}_{ij}}{\sum_{i=1}^{n} \boldsymbol{X}_{ij}} = \frac{\boldsymbol{X}_{ij}}{\boldsymbol{X}_j} \qquad \boldsymbol{g}_{ij}^s = \frac{\boldsymbol{X}_{ij}}{\sum_{j=1}^{m} \boldsymbol{X}_{ij}} = \frac{\boldsymbol{X}_{ij}}{\boldsymbol{X}_i}$$

The symbols in the formulas are as follows:

$\boldsymbol{H}_j^c$ – HH index of geographic concentration;
$\boldsymbol{H}_i^s$ – HH index of regional specialization;
i – region (county) 1,2,3,…, n; *j* – economic activity 1,2,3,…, m;
$\boldsymbol{X}$ – total GVA;

$\boldsymbol{X}_{ij}$ – GVA in economic activity *j* and region *i*;
$\boldsymbol{X}_{j}$ – total GVA of the economic activity *j*;
$\boldsymbol{X}_{i}$ – total GVA in region *i*;
$\boldsymbol{g}_{ij}^{c}$ – share of the region *i* in total national GVA of the economic activity *j*;
$\boldsymbol{g}_{ij}^{s}$ – share of the economic activity *j* in total GVA of the region *i*.

The Herfindahl-Hirschman (HH) index increases with the degree of concentration or specialization and can reach a maximum value of 1 if activity *j* is concentrated in a single region, or if region *i* is specialized in only one activity. The lowest level of concentration is 1/n, which occurs when all regions have equal shares in activity *j*, while the lowest level of specialization is 1/m, which indicates that all activities have equal shares in region *i*. This means that the lower bound of the HH index is sensitive to the number of observations, limiting direct comparisons (e.g., countries must have the same number of regions), which is its main drawback. Another limitation is that the HH index is an absolute measure, meaning that regions with higher shares disproportionately affect changes in concentration and specialization (the index is biased towards larger regions) (Goschin et al. 2009).

The coefficient of variation (CV), a standardized measure of income dispersion among regions, is used to assess regional economic disparities. It is calculated as the ratio of the standard deviation of regional GDP per capita to its arithmetic mean (Everitt, 1998):

$$CV = \frac{\sigma}{\mu} * 100\%$$

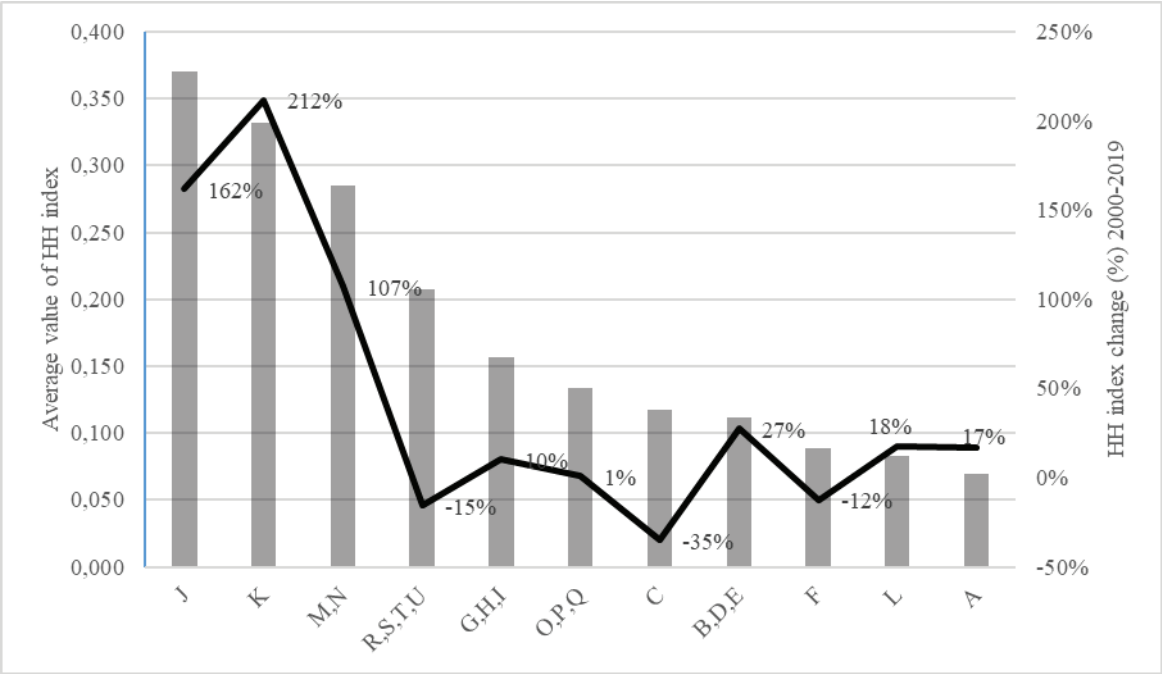
Where σ represents the standard deviation of regional GDP per capita, and μ represents the arithmetic mean of regional GDP per capita. Higher values of the coefficient of variation indicate greater regional disparities, while lower values suggest convergence between regions. This method enables the monitoring of regional disparities over time and their connection to the processes of specialization and concentration.

In terms of data, the calculation of the HH concentration and specialization index uses data from the Central Bureau of Statistics on gross value added (GVA) for the Republic of Croatia and its counties, categorized by NKD 2007 activities, for the period 2000-2019, in euros at fixed exchange rates. Due to the lack of more detailed data on industry branches at the county level, broader economic classes are used for GVA. This approach provides each county with greater potential for specialization within a certain group of activities, rather than individual sectors. The same applies to concentration. Although an activity may be present exclusively in one county, its concentration might not be clearly visible because it is grouped with other activities (e.g., activity R (Human health and social work activities) is combined with other service activities (S, T, and U)). To calculate the coefficient of variation (CV) as a measure of regional disparities, GDP per capita at the county level, in euros at fixed exchange rates for the period 2000-2019, is used. An increase in the coefficient of variation indicates that income differences between counties are growing, suggesting an increase in regional disparities. Conversely, a decrease in the coefficient of variation reflects lower income variability among counties, pointing to a reduction in regional inequalities.

4. Results and discussion

The calculated HH concentration indices, based on data on gross value added (GVA) by activity areas of the NKD 2007 for the period 2000-2019, reveal significant differences among activities. The most concentrated activity is J (Information and communication), with an average HH index value of 0.370 for the period 2000-2019, followed by activity K (Financial and insurance activities) with an average value of 0.331, and activities M and N (Professional, scientific, technical, administrative, and support service activities) with an average value of 0.285. These three activities also experienced the largest increase in the HH index between 2000 and 2019, with activity K (Financial and insurance activities) standing out in particular, as its HH index increased by 212%. The least concentrated activity is Agriculture, forestry and fishing (A), with an average HH index value of 0.069. It is also noteworthy that the manufacturing industry (C) had the largest decrease in the HH index between 2000 and 2009, with a reduction of 35%, indicating that it became more dispersed over time (see Graph 1). This trend coincides with the relative loss of importance of the manufacturing industry for the Croatian economy (relative deindustrialization). Specifically, from 2000 to 2019, the share of the manufacturing industry in Croatia's economy decreased from 16.7% to 12.0% (share in total GVA).

Graph 1: Average value and change in the Herfindahl-Hirschman concentration index based on GVA data for 2000–2019.

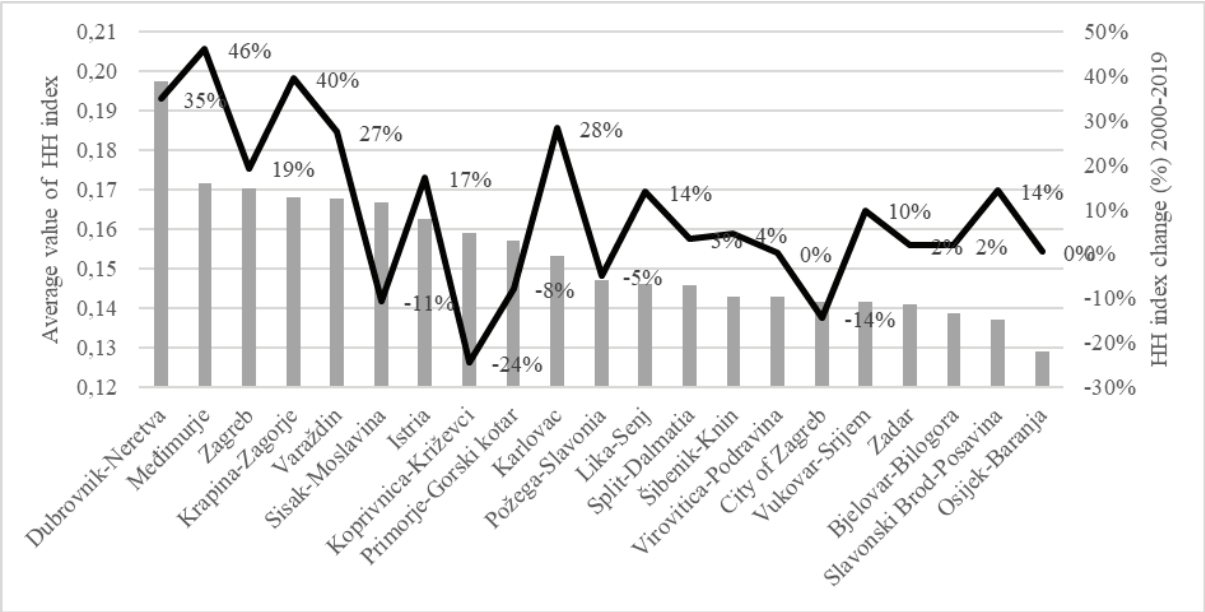


Source: Croatian Bureau of Statistics (2025)

The Herfindahl-Hirschman index is also calculated for Croatian counties to analyze trends in their specialization. In this case also, data on GVA by counties and NKD 2007 activities from 2000 to 2019 is used. The highest HH index is in Dubrovnik-Neretva County, with an average value of 0.197 from 2000 to 2019. This county also experienced the third-largest increase in the HH index of specialization during the same period, with a growth of 35%. This increase can largely be attributed to the significant growth in the share of Construction (F) (from 4% to 12% in the county's total GVA) and Wholesale and retail trade, transport and storage, accommodation, and food preparation and serving activities (G, H, I) (from 28% to 41%). These activities are closely linked to tourism, which explains the specialization pattern in this

county. Among other counties with increasing specialization, Međimurje County stands out with a growth of 46%, followed by Krapina-Zagorje County with a growth of 40% (see Graph 2). The largest decrease in the HH index from 2000 to 2019 is recorded in Koprivnica-Križevci County, which saw a 24% decline, primarily due to a decrease in the share of the manufacturing industry from 38% to 27% in total GVA. Osijek-Baranja County has the lowest average HH specialization index value (0.129), meaning it has the most balanced economic structure among Croatian counties.

Graph 2: Average value and change in the Herfindahl-Hirschman specialization index based on GVA data for 2000–2019



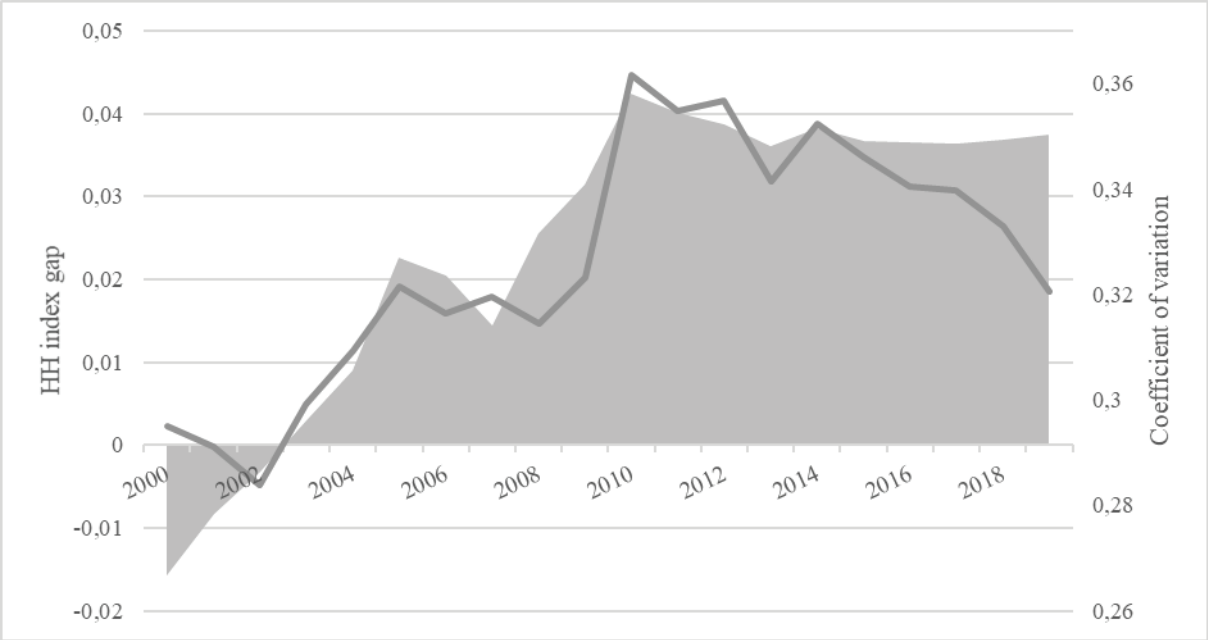
Source: Croatian Bureau of Statistics (2025)

The following is an analysis of the gap between concentration and specialization, and its relationship with the evolution of regional disparities, as measured by the coefficient of variation (CV). By examining the average values of the HH concentration and specialization indices for the period 2000-2019 and observing their gap, it becomes evident that this gap is increasing over time—i.e., concentration is growing faster than specialization. When the concentration of economic activity grows faster than regional specialization, it indicates that economic activities are increasingly concentrated in a few regions, while other regions are not specializing enough to develop their own competitive advantages. From the perspective of regional disparities, a higher concentration of economic activity attracts new workers, further reducing the economic potential of weaker regions and contributing to depopulation. Additionally, a high concentration of economic activity in a small number of regions can make the entire economy more sensitive to local shocks or structural changes in the dominant industries of these regions. Similarly, a decline or slower growth in specialization means that regions fail to develop their own specialized sectors and become economically dependent on more developed regions, which can limit their capacity for independent innovation and long-term development.

Graph 3 shows the relationship between the HH index gap (the gap of Herfindahl-Hirschman index between the concentration and specialization) (left axis) and the coefficient of variation (right axis), which measures regional disparities in Croatia. From 2000 to 2010, the gap between concentration and specialization (the HH index gap) increased, meaning that

economic activity was concentrating in certain regions faster than regions were specializing. In parallel, the coefficient of variation also rose, suggesting that regional disparities were increasing. The HH index gap peaked around 2010, which may indicate that concentration significantly exceeded specialization at that point. The coefficient of variation was also at its highest level during this period, confirming that regional disparities were pronounced. After 2010, an interesting trend emerges. Both indicators began to decline, but with a key difference. From 2010 to 2014, the HH index gap and the coefficient of variation decreased in parallel, suggesting that regional disparities were diminishing alongside the gap between concentration and specialization. However, since 2014, the coefficient of variation has decreased rapidly, while the HH index gap has stagnated until 2019, indicating that regional disparities continued to decline despite the concentration-specialization ratio. A possible explanation for this trend is that Croatia's EU membership, starting in 2013, provided access to EU structural and cohesion funds aimed at reducing regional inequalities and stimulating the development of less developed regions. The decrease in the coefficient of variation after 2014 may reflect the positive impact of EU funds on the economic development of these regions, regardless of the concentration of economic activity. Notably, during the 2014-2020 EU budget cycle, Croatia gained access to EUR 12.19 billion (European Commission, 2025).

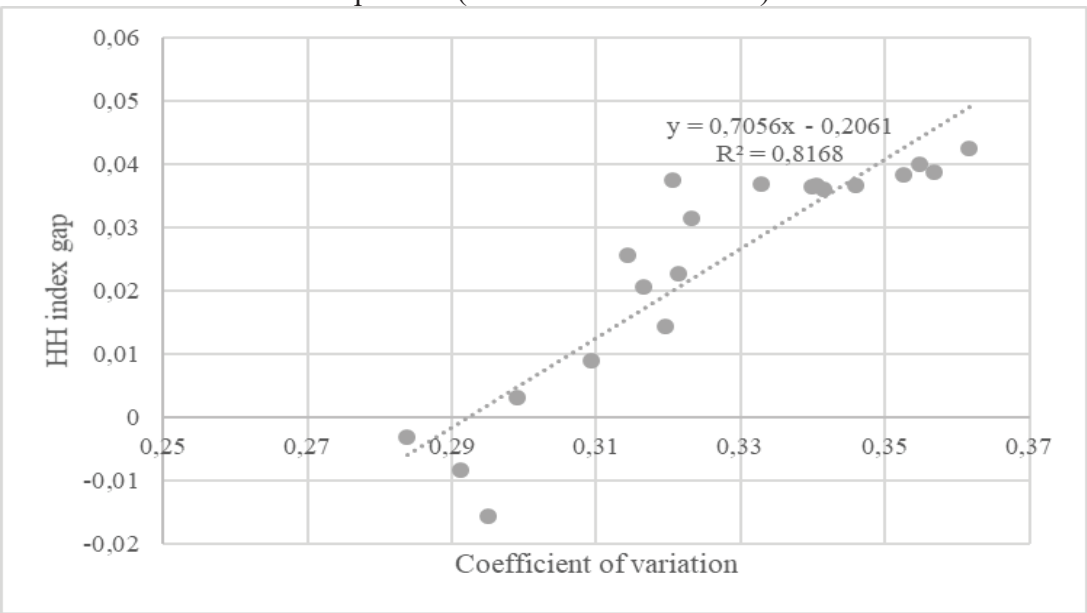
Graph 3: Trends in the concentration-specialization gap (HH index gap) and regional disparities (coefficient of variation)



Source: Authors' own calculations based on data from the Croatian Bureau of Statistics (2025)

Additional confirmation of the previous analysis is provided by Graph 4, which illustrates the relationship between the concentration-specialization gap and regional disparities, i.e., between the HH gap index and the coefficient of variation. While Graph 3 shows trends over time, this scatterplot confirms the existence of a strong statistical relationship between the two indicators. The positive slope of the regression line indicates a positive relationship: as the gap between concentration and specialization increases, so does the coefficient of variation, reflecting greater regional disparities. Furthermore, the coefficient of determination (R^2 = 0.8168) suggests a strong correlation between the two variables. The Pearson correlation coefficient between the HH gap index and the coefficient of variation for the period 2000-2019 is also calculated. It amounts to 0.9037 (t-value is 8.9573 and p-value is 0.0000), which shows a very strong positive correlation between these two variables.

Graph 4: Relationship between concentration-specialization gap (HH index gap) and regional disparities (coefficient of variation)



Source: Authors' own calculations based on data from the Croatian Bureau of Statistics (2025)

5. Discussion and conclusion

This paper examines trends in the geographic concentration of economic activities and regional specialization, as well as their relationship with regional disparities in Croatia during the period 2000–2019. Although concentration and specialization are often explicitly or implicitly treated as related phenomena, these processes may move in opposite directions or at different paces. The results of the empirical analysis show that the rate of concentration has increased faster than specialization, leading to a widening gap between them (measured by the difference between the Herfindahl-Hirschman concentration and specialization indices). At the same time, regional disparities (measured by the coefficient of variation) have also increased. The Pearson correlation coefficient indicates a strong positive relationship between the concentration-specialization gap and regional inequality. However, after 2014, the gap stagnated, and regional disparities began to decline. The possible reason is that Croatia's accession to the European Union in 2013 facilitated access to EU structural and cohesion funds aimed at reducing regional disparities, regardless of concentration and specialization trends. Nevertheless, addressing regional disparities requires a comprehensive policy approach that balances economic concentration with regional specialization. Encouraging diversification, strengthening human capital, improving infrastructure, and implementing targeted fiscal measures can help mitigate the negative effects of these imbalances. Ultimately, achieving sustainable and inclusive regional development requires a strategic combination of national policies and local initiatives that promote both economic efficiency and territorial equity.

The paper provides several policy recommendations. First, promoting economic diversification at the county level—particularly through the growth of small and medium-sized enterprises—can reduce reliance on a few dominant industries. Second, fostering innovation and human capital development would enhance competitiveness and create stronger prospects for regional specialization. Additionally, improving connectivity across Croatia—not only in transport infrastructure but also in digital and energy networks—would

increase regional specialization potential, attracting investment, innovation, and knowledge spillovers. To implement these measures, targeted financial support—such as tax incentives and grants—should be introduced. For instance, establishing special economic zones (SEZs) and industrial clusters could encourage more balanced regional growth. Finally, a bottom-up approach to decision-making is essential. Greater decentralization would empower local governments to tailor economic policies to their unique needs, fostering healthy competition among Croatian counties in attracting businesses and people.

It is important to acknowledge several limitations of this paper. Firstly, the analysis is based on descriptive statistics and uses an absolute indicator to calculate concentration and specialization coefficients. The use of relative indicators could offer a different perspective on regional variations and dynamics. Moreover, the paper does not incorporate spatial econometric techniques or methods for identifying causal relationships. The findings would be more robust if less aggregated data were available, ideally at the firm level. However, data availability poses a significant constraint for this type of analysis. These limitations also provide a foundation for future research. The application of spatial econometric techniques would help address the issue of spatial autocorrelation, while the use of microdata in dynamic panel models could offer deeper insights into the mechanisms of concentration and specialization. Additionally, incorporating variables related to EU funding would contribute to a better understanding of the drivers behind regional disparities and the effectiveness of cohesion policies in reducing them.

REFERENCES

Aiginger, K. (1999): ***Do Industrial Structures Converge? A Survey on the Empirical Literature on Specialisation and Concentration of Industries***, WIFO Working Papers, No. 116, Austrian Institute of Economic Research (WIFO), Vienna.

Aiginger, K. and Leitner, W. (2002): ***Regional concentration in the United States and Europe: Who follows whom?*** Weltwirtschaftliches Archiv 138, pp. 652–679 (2002). https://doi.org/10.1007/BF02707656

Aiginger, K. and Rossi-Hansberg, E. (2006): S***pecialization and concentration: a note on theory and evidence***, Empirica 33, pp. 255–266. https://doi.org/10.1007/s10663-006-9023-y

Amiti, M. (1999.): ***Specialisation Patterns in Europe***, Weltwirtschaftliches Archiv, Vol. 135 (4), pp. 573-593.

Bickenbach, F. and Bode, E. (2008): ***Disproportionality Measures of Concentration, Specialization, and Localization***. International Regional Science Review. 31. 10.1177/0160017608319589.

Croatian Bureau of Statistics (2025): ***Database/podaci***, available at: https://podaci.dzs.hr/en/, retrieved: 10.03.2025.

Cutrini, E. (2009): ***Specialization and Concentration from a Twofold Geographical Perspective: Evidence from Europe***. Regional Studies, 44(3), 315–336. https://doi.org/10.1080/00343400802378743

Dalum, B., Laursen, K. and Villumsen, G. (1998): ***Structural Change in OECD Export Specialization Patterns: De-specialization and „Stickiness“***, Department of Business Studies, Aalborg university.

Ezcurra, R., Pascual, E. and Rapun, M. (2006): ***The dynamics of industrial concentration in the regions of the European Union***, Growth and Change, Vol. 37, No.2, pp. 200–229.

European Commission (2025): ***Cohesion Open Data Platform***, available at: https://cohesiondata.ec.europa.eu/countries/HR/14-20, retrieved: 5.2.2025.

Everitt, B. (1998): ***The Cambridge Dictionary of Statistics***. Cambridge, UK New York: Cambridge University Press. ISBN 978-0521593465.

Fujita, M., Krugman, P. i Venables, A. (1999): ***The Spatial Economy: Cities, Regions and International Trade***, MIT Press, Cambridge, MA.

Gervais, A., Markusen, J. R. and Venables, A. J. (2024): ***Regional specialization: From the geography of industries to the geography of jobs***, Canadian Journal of Economics, Vo. 57, No. 4, pp. 1236-1264, https://doi.org/10.1111/caje.12747

Goschin, Z., Constantin, D. L., Roman, M. and Ileanu, B. (2009): ***Regional Specialisation and Geographic Concentration of Industries in Romania***, South-Eastern Europe Journal of Economics, Association of Economic Universities of South and Eastern Europe and the Black Sea Region, vol. 7(1), pp. 99-113.

Hallet, M. (2000): ***Regional specialisation and concentration in the EU***, Economic Papers, 141, European Commission, Brussels.

Hirschman, A. O. (1958): ***The strategy for economic development***, New Haven, CT: Yale University Press.

Isard, W. (1956): ***Regional science, the concept of region, and regional structure***, Papers in Regional Science, Vol. 2, br. 1, pp. 13–26.

Krugman, P. (1991a): ***Geography and Trade***, The MIT Press, Cambridge, Massachussets.

Krugman, P. (1991b): ***Increasing Returns and Economic Geography***, Journal of Political Economy, Vol. 99, No. 3, pp. 483-499.

Krugman, P. and Obstfeld, M. (2009): ***Međunarodna ekonomija: teorija i ekonomska politika***, 7th edition, Mate d.o.o., Zagreb.

Kuznets, S. S. (1955): ***Economic Growth and Income Inequality***, American Economic Review 45 (March), pp. 1–28.

Lehocký, F. and Rusnák, J. (2016): ***Regional specialization and geographic concentration: experiences from Slovak industry***, Miscellanea Geographica – Regional Studies on Development, Vol. 20, No. 3, pp. 5-13. DOI: 10.1515/mgrsd-2016-0011.

Long, C. and Zhang, X. (2012): ***Patterns of China's industrialization: Concentration, specialization, and clustering***, China Economic Review, Vol. 23, No. 3, 2012, pp. 593–612.

Martin, R. and Sunley, P. (2015): ***On the notion of regional economic resilience: conceptualization and explanation***, Journal of Economic Geography, Vol. 15, Issue 1, pp. 1–42, https://doi.org/10.1093/jeg/lbu015

North, D. (1955): ***Location theory and regional economic growth***, Journal of Political Economy, Vol. 63, No. 3, pp. 243–258.

Ohlin, B. (1933): ***Interregional and International Trade***, Harvard University Press, 1967.

Palan, N. (2010): ***Measurement of Specialization - The Choice of Indices***, FIW Working Paper, No. 62, FIW - Research Centre International Economics, Vienna

Park, S.-C. (2003): ***Specialization and Geographical Concentration in East Asia: Trend and Industry Characteristics***, KIEP Working Paper 03-16.

Rhoades, S. A. (1993): ***The Herfindahl-Hirschman Index***. Federal Reserve Bulletin. 79 (March 1993). Federal Reserve Bank of St. Louis: pp. 188–189.

Rossi-Hansberg, E. (2005): ***A spatial theory of trade***, American Economic Review, 95(5), pp. 1464-1491.

Sekur, T. (2018): ***Regionalna specijalizacija i geografska koncentracija industrije u Hrvatskoj***, in: Conference proceedings of „Modeli razvoja hrvatskog gospodarstva“ (Ed. Družić, G.; Družić, I.). Zagreb: HAZU and FEB, edition 1, volume 1, chapter 13, pp. 309-330.

Traistaru, I., Iara, A. and Pauna, C. (2002a): ***Regional structural change and growth in Romania***, paper presented at the 42nd Congress of European Regional Scientific Association, Dortmund.

Traistaru, I., Nijkamp, P. and Longhi, S. (2002b): ***Regional specialization and concentration of industrial activity in accession countries***, ZEI Working Paper, No. B 16-2002, Rheinische Friedrich-Wilhelms-Universität Bonn, Zentrum für Europäische Integrationsforschung (ZEI), Bonn

Williamson, J.G. (1965): ***Regional Inequality and the Process of National Development: A Description of the Patterns***, Economic Development and Cultural Change, vol. 13, no. 4, pp. 3–45.

A scientific paper

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LOCAL GOVERNMENT EFFICIENCY IN SLAVONIA: A DEA-BASED ASSESSMENT OF COMMUNITY DEVELOPMENT

ABSTRACT

This paper assesses the relative efficiency of 127 local governments (LGs) in the Slavonia region of Croatia, encompassing both cities and municipalities. Slavonia is marked by persistent development challenges, including economic underperformance, demographic decline, and structural inequalities. The primary aim of the paper is to identify the LGs most efficient at transforming limited public resources into positive community development outcomes, and to provide a comparative basis for policy improvement and resource optimization. A two-stage non-parametric Data Envelopment Analysis (DEA) approach was applied. In the first stage, an input-oriented BCC model was used to assess the relative efficiency of LGs in converting total public expenditures into outputs across five development dimensions: economic development, education, environmental sustainability, digital infrastructure, and civic participation. In the second stage, a super-efficiency model was employed to enable full ranking, identify benchmark units, and support performance-based clustering. The analysis was first conducted on the full sample of LGs, and subsequently on separate subsamples of cities and municipalities. The results reveal considerable variation in efficiency levels. Only a few LGs – most notably the municipalities of Čeminac, Klakar, and Punitovci, and the City of Osijek – achieved benchmark status in both the overall and subgroup analyses. These units demonstrated a high capacity to deliver better-than-average development outcomes with relatively limited financial input. Conversely, many LGs showed substantial inefficiencies, highlighting the need for targeted capacity-building and improved resource alignment. The findings demonstrate that efficiency is not determined solely by LG size or available resources, but also by the strategic deployment of those resources. The study provides a replicable model for evaluating LG efficiency and contributes to policy efforts aimed at fostering balanced and sustainable local development.

Key words: *local government efficiency, DEA, Slavonia, community development, benchmark units.*

1. Introduction

In recent years, the growing emphasis on evidence-based public management has intensified the need to evaluate the performance and efficiency of LGs in delivering public services and fostering community development. As public resources remain constrained and citizen expectations increase, understanding how efficiently local governments transform inputs – such as financial and human resources – into meaningful developmental outcomes has become a key policy concern. While numerous studies have assessed LG performance across various countries, little empirical research has focused on Croatia, and even less so on its economically underdeveloped eastern region of Slavonia.

Slavonia is a region characterized by persistent demographic decline, below-average economic indicators, and structural development challenges (World Bank, 2019). In this context, the ability of LGs to use public resources efficiently is not only a matter of fiscal responsibility, but a prerequisite for sustainable development and social cohesion. This study addresses this gap by conducting a comprehensive efficiency analysis of 127 LGs – both cities and municipalities – across five Slavonian counties. The analysis uses DEA, a well-established non-parametric technique, to assess the relative efficiency of LGs in translating budgetary expenditures into a multi-dimensional set of community development outcomes.

The selected output indicators reflect critical dimensions of development aligned with the United Nations Sustainable Development Goals (SDGs), including economic prosperity, educational attainment, environmental sustainability, digital access, and democratic participation. The results reveal substantial variation in efficiency among LGs, with only a small number achieving benchmark status. Benchmark units are shown to produce consistently high-quality development outcomes relative to their expenditure levels. Interestingly, some small municipalities outperform large, better-resourced cities, indicating that structural limitations do not necessarily preclude high efficiency. These findings underscore the importance of efficient resource allocation and can inform targeted policy interventions aimed at improving local service delivery. This study contributes to both the academic literature and public policy by offering a replicable, data-driven approach to assessing LG efficiency in a context marked by development disparities and constrained fiscal capacities.

The remainder of this paper is organized as follows. The next section reviews the relevant literature on LG efficiency and the application of DEA in public sector evaluation. This is followed by a detailed description of the methodology and data sources used. The results section presents findings from the two-stage DEA analysis, including efficiency scores, clustering, and group-wise comparisons between cities and municipalities across different efficiency clusters. The final section discusses key implications, offers policy recommendations, and concludes with a suggestion of directions for future research.

2. Literature Review

Numerous empirical studies have employed non-parametric methods to evaluate the efficiency of LGs, particularly in terms of public spending and service delivery. These studies typically investigate how efficiently LGs convert limited resources – financial, human, or infrastructural – into service delivery indicators, often comparing units across municipalities, regions, or metropolitan areas. DEA has been widely used across European contexts. For example, Geys & Moesen (2009) evaluated the efficiency of 304 Flemish municipalities using both DEA and free disposal hull (FDH) as non-parametric methods. The model included total expenditures as the input and several output variables reflecting the provision of public goods, such as recreational surface area, number of primary school pupils, length of local roads, and volume of waste collected. Balaguer-Coll & Prior (2009) examined the efficiency of 258 Spanish municipalities using DEA, with budgetary data as inputs and several proxy outputs for local service provision, including population, waste collection, and street infrastructure. Their findings indicate that exogenous factors – such as municipal size, tax revenue, and per capita grants – are key drivers of inefficiency. Similar studies have been conducted in some post-transition European economies, including Slovenia, Bosnia and Herzegovina, Czechia, and Macedonia (Nikolov, 2013; Pevcin, 2013; Šehić, Osmanković, & Galić, 2013; Staníčková & Melecky, 2012). These studies commonly address decentralization challenges, administrative

fragmentation, and EU funding dynamics as influential factors affecting efficiency scores. Some studies complement non-parametric approaches with parametric techniques such as stochastic frontier analysis (SFA) to improve interpretability and account for the influence of exogenous variables (e.g. Lazović-Pita & Šćeta, 2021; Nikolov, 2013).

The existing literature on public sector efficiency in Croatia predominantly addresses efficiency benchmarking at the county level, although the approaches and emphases differ. Hodžić & Muharemović (2019) examine the efficiency of 20 Croatian counties between 2009 and 2016, using total public expenditures as input and service-related outputs such as numbers of school pupils, healthcare visits, road length, and public lighting infrastructure. They find that only two exogenous factors – unemployment rate and average wage – significantly affect efficiency outcomes. Škuflić, Rabar, & Šokčević (2010) assess counties' capacity to generate economic output using inputs like the number of graduates, legal entities, foreign direct investment (FDI), and equipment value. Their output variables include GDP and investment in fixed assets, and the study reveals considerable regional variation in the utilization of economic potential. A complementary perspective is provided by Rabar (2013), who applies DEA over the 2005–2007 period using social vulnerability indicators – unemployment rate and number of social support users – as inputs, and five outputs including GDP, investment, export coverage, secondary sector GVA, and number of graduates. The study combines window and categorical analysis to highlight the ways in which structural characteristics impact county-level efficiency, particularly to the benefit of inland counties. Slijepčević (2019) introduces a more holistic approach by using a composite performance indeks – combining economic, social, and demographic indicators – as output, and total public expenditures as input. The results point to substantial inter-county disparities, with the least efficient counties requiring a 55% expenditure reduction to reach the efficiency frontier. Other research applies DEA to specific public sectors at the municipal level, such as entrepreneurial zones (Šmaguc & Vuković, 2018) and e-government services (Jardas Antonić & Šegota, 2017; Šegota, Jardas Antonić, & Rakamarić Šegić, 2013), identifying inefficiencies in targeted policy areas.

While a number of DEA-based studies exist at the county level in Croatia, research focusing on the local level of government – i.e., municipalities and cities – remains limited. Most analyses rely on county-level data due to greater data availability and the administrative role of counties as coordinators of regional development policy, EU funding, education, healthcare, and other public services. However, this approach may overlook intra-regional variation and local-specific development dynamics. To address this gap, this study applies DEA at the local level within a single macro-region – Slavonia – characterized by structural challenges and long-term underdevelopment. By doing so, it offers a more granular perspective on government efficiency and provides evidence for more targeted, locally-responsive policy design.

3. Methodology and data

This study employs DEA to evaluate the relative efficiency of 127 LGs in Slavonia, Croatia. DEA is a non-parametric method based on linear programming that assesses the efficiency of decision-making units (DMUs) by comparing multiple inputs and outputs. Specifically, I adopt the BCC (Banker, Charnes, & Cooper, 1984) model with an input-oriented approach to measure the efficiency of municipalities and cities in resource utilization while maximizing community development outcomes. An input-oriented DEA approach measures how much a municipality can reduce its input usage (e.g., budget, staff) while still maintaining the same level of community development outcomes. This approach is particularly useful for LGs, in which

financial and human resources are often constrained, and improving efficiency means doing more with less (Ammons, 2020). For example, if two municipalities achieve similar levels of economic and social development, but one spends significantly more on public services, the input-oriented model would identify this municipality as inefficient and suggest potential cost reductions that could be achieved without sacrificing service quality. Also, DEA BCC measures relative efficiency, meaning that each LG's efficiency score is assessed in comparison to other LGs in the dataset rather than against an absolute standard (Charnes, Cooper, & Rhodes, 1978). Thus, an efficiency score of 1 (100%) indicates that a LG is efficient relative to its peers, but not necessarily in absolute terms. Since efficiency scores depend on the sample of LGs analyzed, changes in the dataset can affect results. That is why I first analyzed all LGs together, followed by a separate efficiency analysis of cities and municipalities.
The efficiency score for each DMU is obtained by solving the following linear programming problem:

$$\min_{\theta\lambda} \theta_0$$

subject to (1)

$$\begin{gathered} -y_0 + Y\lambda \geq 0, \\ \theta x_0 - X\lambda \geq 0, \\ e^T\lambda = 1, \\ \lambda \geq 0, \end{gathered}$$

where x_0 and y_0 are vectors of input and output values for each DMU, θ_0 represents the efficiency score (values between 0 and 1, where 1 indicates full efficiency). The vectors $X\lambda$ and $Y\lambda$, where $\lambda = (\lambda_1, \dots, \lambda_n), \lambda > 0$, represent the weighted sums of input and output contributions from efficient DMUs to project a given DMU onto the efficient frontier. The vector e^T is a unit vector used in the convexity constraint of the BCC model to ensure that the model accounts for variable returns to scale (VRS). In such settings, the DEA BCC input-oriented model assigns efficiency scores to each LG, identifying those operating efficiently and those requiring improvements (Banker et al., 1984).

Table 1 presents the definitions of the variables used in the efficiency analysis. Two inputs were initially considered: total LG expenditures and average number of employees based on working hours. However, preliminary results revealed a substantial number of DMUs achieving the maximal efficiency score of 1 when both inputs were included. Consequently, the decision was made to use only total LG expenditures as the single input variable. There are several reasons for this methodological choice. First, there is otherwise a lack of discriminatory power, i.e. when many DMUs receive an efficiency score of 1, the DEA model loses its ability to discriminate effectively among units (Cooper, Seiford, & Zhu, 2011). Therefore, reducing the number of inputs enhances the discriminatory capability of the model, facilitating clearer identification of relatively efficient and inefficient LGs. Second, the correlation analysis revealed a high positive correlation (r = 0.91) between total expenditures and the average number of employees, indicating significant redundancy. Using highly correlated inputs can lead to redundancy, decreasing the discriminatory power of the DEA model and potentially distorting efficiency scores (Wagner & Shimshak, 2007). Third, employing a single critical input enhances the clarity and interpretability of DEA results. Such an approach simplifies policy interpretation, allowing clearer and more actionable conclusions and policy recommendations. Therefore, I opted to use a single input variable – total LG expenditures – which represents the overall level of financial resources utilized by LGs in their provision of public goods and services. This input captures the total budgetary allocation, reflecting both the scale of government activities and their financial intensity. In the context of this DEA efficiency analysis, total expenditures serve as a comprehensive proxy for the government's resource

usage, incorporating administrative, operational, and service delivery costs. Also, total expenditures comprehensively capture governmental resource allocation, effectively aligning with the selected output dimensions of local government performance.

The selection of output variables was guided by their relevance for community development, previous research (e.g. Balaguer-Coll & Prior, 2009; Geys & Moesen, 2009; Gidion, 2023; Ríos, Guillamón, Cifuentes-Faura, & Benito, 2022), and data availability. Additionally, the chosen outputs align closely with the SDGs, ensuring that key aspects of economic, social, environmental, and institutional development correspond with global sustainability priorities. Specifically, the selected variables align – either directly or indirectly – with SDG targets related to: economic growth (SDG 8) – promoting inclusive economic development at the local level; education (SDG 4) – emphasizing access to higher education as a means of fostering lifelong learning and skill development; environmental sustainability (SDGs 11 & 12) – particularly in relation to waste management and sustainable urban planning; digital infrastructure (SDG 9) – ensuring access to information and communication technologies (ICTs) as a critical component of development; democratic participation (SDG 16) – particularly in terms of fostering inclusive and participatory decision-making at the local level.

Table 1: Definition of variables

Variable Type	Component of Community Development	SDG	Variable	Definition	Data Source (year of observation)
Input	-	-	Total expenditures	Total budgetary expenditures of the LG	Ministry of Finance (2023)
Outputs	Economic development	SDG 8: Decent Work and Economic Growth	Local Development Index	A composite indicator used to assess the socio-economic development levels of LGs	Ministry of Regional Development and EU Funds (2024)
	Social development	SDG 4: Quality Education	Higher education attendance	The number of people attending professional or university studies by LG	Croatian Bureau of Statistics (2021)
	Environmental sustainability	SDG 11: Sustainable Cities and Communities; SDG 12: Responsible Consumption and Production	Waste management infrastructure	Total municipal waste collected by LG (in tons)	Ministry of Environmental Protection and Green Transition (2023)
	Digital Infrastructure	SDG 9: Industry, Innovation, and Infrastructure	Internet access	Percentage of households in a LG with broadband Internet access with data transmission rates of 2 Mbit/s or more	Croatian Regulatory Authority for Network Industries (2020)
	Community participation	SDG 16: Peace, Justice, and Strong Institutions	Voter turnout	Voter turnout for local executive and representative authorities (average)	State Electoral Commission (2021)

Source: Author

When it comes to the years of observation, this study uses the most recent available year – 2023. The variables *voter turnout* and *higher education attendance* are from 2021, as they were

obtained from the population census. The variable *local development index 2024* is composed of a series of indicators for the period 2020–2022, including the unemployment rate, per capita income, local government revenue per capita, population change, education rate, and aging index.

4. Results

The descriptive statistics provided in Table 2 summarize input and output variables across three categories: all local governments, cities and municipalities. For total expenditures, cities have a notably higher average (approximately €19 million) than municipalities (about €2 million), with large variations among cities, ranging from €3.8 million in Kutjevo to €120 million in Osijek. The local development index (*devel_index*) shows that cities generally have higher mean scores (99.04) than municipalities (92.89), suggesting greater development. Attendance in higher education studies (*high_edu_attend*) also shows significant differences in terms of the number of people, with cities averaging 804.36 individuals as against just 78.42 individuals in municipalities. Similarly, cities produce considerably more waste (5,166 tons on average) than municipalities (457 tons). Internet accessibility (*int_acc*) is slightly better in cities (mean = 47.04%) than in municipalities (mean = 41.87%). Interestingly, voter turnout (*vot_turn*) is somewhat higher in municipalities (average of 51.17%) than in cities (average of 44.98%), with considerable variation among municipalities, ranging from 25.1% in Semeljci to 76.7% in Punitovci.

Table 2: Descriptive statistics

Variable		Mean	Std. dev.	Min	Max
	all	4,989,066	12,338,168	674,746	120,286,289
total_expenditures	cities	19,165,377	25,534,259	3,832,267	120,286,289
	municipalities	2,018,791	1,166,050	674,746	7,534,365
	all	93.96	4.29	82.80	106.77
devel_index	cities	99.04	3.15	94.81	106.77
	municipalities	92.89	3.69	82.80	100.87
	all	204.17	556.26	14	5,511
high_edu_attend	cities	804.36	1,175	138	5,511
	municipalities	78.42	61.19	14	405
	all	1,273	3,595	89	35,684
waste_tons	cities	5,166	7,605	496	35,684
	municipalities	457	316	89	1.865
	all	42.76	6.94	25.39	62.46
int_acc	cities	47.04	6.89	34.79	62.46
	municipalities	41.87	6.64	25.39	57.68
	all	50.10	10.40	25.09	76.70
vot_turn	cities	44.98	6.33	30.92	59.67
	municipalities	51.17	10.78	25.09	76.70

Source: Author

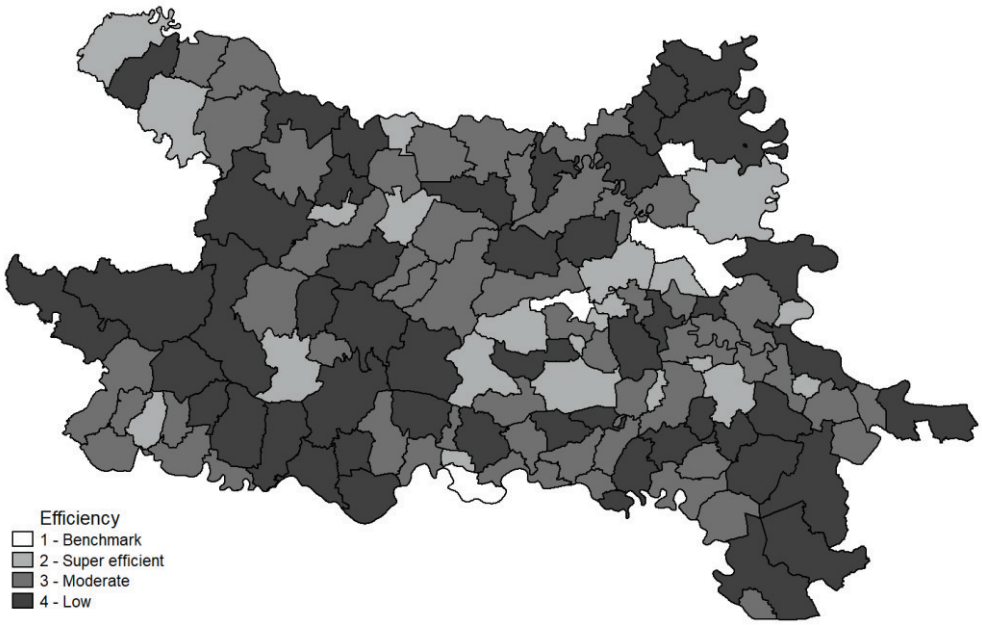
Given these notable differences between municipalities and cities, the analysis will first be conducted collectively for all local governments, followed by separate analyses specifically for municipalities and cities.

In the first stage, I conducted the initial DEA analysis which provided efficiency scores where around 20% of LGs achieved a maximum efficiency score of 1, indicating efficiency but also limiting differentiation among top performers. To further differentiate these efficient units and establish a clearer ranking, a subsequent super-efficiency DEA analysis was conducted in the second stage. Unlike standard DEA, the super-efficiency method allows for efficiency scores greater than 1, identifying units that outperform their peers and thus can be classified as super-efficient (Andersen & Petersen, 1993). Additionally, this approach provided valuable insights into benchmark units, highlighting best-practice examples and enhancing the robustness of the comparative analysis.

The DEA results for all LGs were categorized into four distinct efficiency clusters (Map 1):

1. Benchmark: this cluster includes four LGs, i.e., the Municipalities of Čeminac, Klakar, and Punitovci, and the City of Osijek, that achieved benchmark status, indicating maximum efficiency. These units represent best-practice examples within the analyzed group. They utilize financial resources (total expenditures) most efficiently to maximize beneficial community outcomes related to economic development (*devel_index*), social development (*high_edu_attend*), environmental sustainability (*waste_tons*), digital infrastructure (*int_acc*), and community participation (*vot_turn*). They set a clear standard by showing the highest possible performance level in community development outcomes per unit of financial expenditure. Therefore, these LGs represent realistic models of how limited resources can be optimally allocated to achieve broad, sustainable, and effective community development aligned with the SDGs.
2. Super-efficient: this cluster comprises 21 LGs identified as super-efficient, with efficiency scores ranging from approximately 1.00 (just above full efficiency) to 4.97 and an average score of 1.59. These LGs clearly outperform the benchmark established in the initial DEA analysis.
3. Moderate efficiency: comprising 53 LGs, this cluster has an average efficiency score of approximately 0.76, indicating moderate efficiency levels. Efficiency scores range from about 0.60 to just below full efficiency (0.99), highlighting the room for improvement that exists in these units.
4. Low efficiency: the lowest-performing group includes 49 LGs with an average efficiency score of roughly 0.49. Efficiency scores here vary significantly, ranging from a low of 0.21 up to 0.60, emphasizing substantial inefficiencies and considerable opportunities for improvement.

Map 1: Two-stage DEA efficiency results for all LGs in Slavonia



Source: Author

The DEA efficiency analysis for cities resulted in four distinct efficiency clusters (Map 2):

1. Benchmark: includes the five cities (Orahovica, Osijek, Otok, Vinkovci and Virovitica) that achieved benchmark status, reflecting optimal performance in converting expenditures into community development outcomes.
2. Super-efficient: this group consists of seven cities with efficiency scores above the standard benchmark (greater than 1). Efficiency scores range from approximately 1.14 to 1.82, averaging around 1.40, highlighting these cities' superior efficiency.
3. Moderate efficiency: comprising seven cities, this cluster has an average efficiency score of approximately 0.83, indicating moderate efficiency. Scores range from around 0.67 to 0.95, showing these cities still have potential for efficiency improvements.
4. Low efficiency: the lowest-performing cluster includes only three cities – Beli Manastir, Vukovar, and Lipik – with an average efficiency score of approximately 0.52. These cities show considerable room for improvement in transforming public expenditures into meaningful community development outcomes.

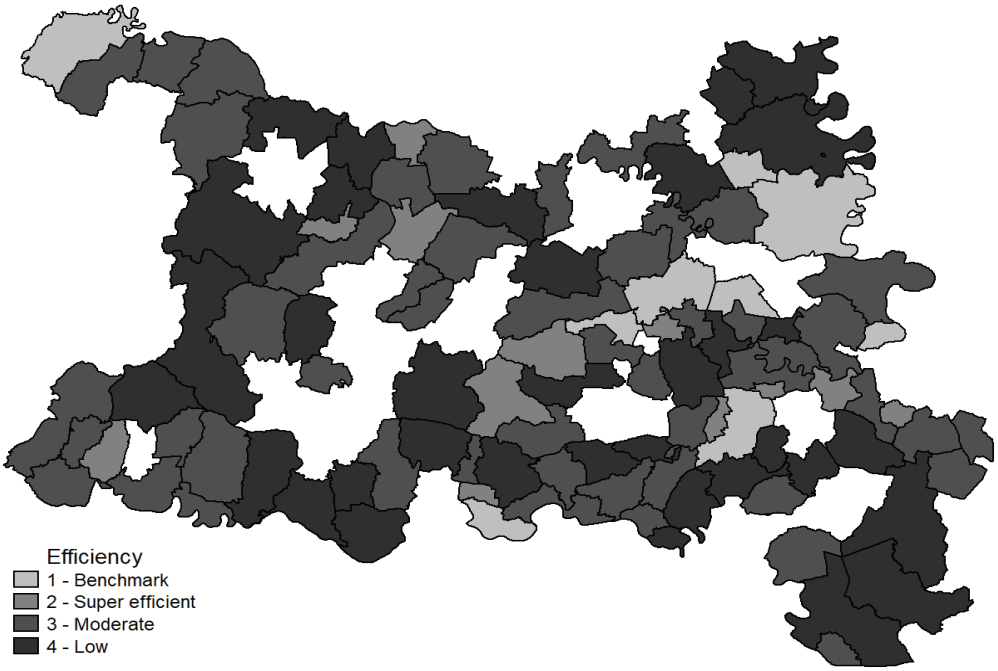
Map 2: Two-stage DEA efficiency results for Slavonian cities

Source: Author

The DEA efficiency analysis for municipalities identified four distinct efficiency clusters (Map 3):

1. Benchmark: this cluster includes the nine municipalities (Antunovac, Bilje, Borovo, Čeminac, Čepin, Ivankovo, Klakar, Pitomača, and Punitovci) that achieved the highest possible efficiency and serve as benchmark units. They represent best-practice examples in the use of public expenditures to achieve strong community development outcomes.
2. Super-efficient: consisting of 13 municipalities, this cluster includes units that exceeded the standard efficiency benchmark, with scores ranging from 1.00 to 1.63 and an average efficiency of 1.21. These municipalities demonstrated performance beyond the reference frontier.
3. Moderate efficiency: this group includes 49 municipalities with an average efficiency score of approximately 0.76. Their efficiency scores range from 0.61 to just below 1.00, indicating generally adequate performance with room for improvement.
4. Low efficiency: comprising 34 municipalities, this cluster shows the lowest average efficiency, at approximately 0.50. Efficiency scores range from 0.21 to 0.60, highlighting significant inefficiencies in the use of expenditures for achieving community development outcomes.

Map 3: Two-stage DEA efficiency results for Slavonian municipalities



Source: Author

The two-stage DEA efficiency results demonstrate how the strong performance of certain LGs holds up under different benchmarking scenarios – whether compared to all LGs or just to their administrative peers. Notably, the municipalities of Čeminac, Klakar, and Punitovci stand out as exceptional examples of LG efficiency. These municipalities not only achieved benchmark status when evaluated among all LGs – including larger, better-resourced cities – but also maintained this status when analyzed solely within the group of municipalities. This confirms that high performance is achievable under varying conditions – whether due to structural differences such as size and capacity, or depending on the composition of the comparison group. For a full list of efficiency scores and cluster assignments, see Appendix, Tables A1-A3.

Table 3 shows that benchmark units, while not necessarily incurring the lowest expenditures per capita (e.g., €898 on average), consistently achieve high values in development-related outputs compared to less efficient clusters. On average, they report the highest share of population enrolled in higher education (3.74%), indicating strong human capital potential. They also demonstrate above-average results in waste management (212 kg of municipal waste collected per capita), internet access (46.9%), and voter turnout (63.9%). Additionally, benchmark units record the highest average value of the local development index, at 99.25. This pattern is even more pronounced among benchmark cities. These findings suggest that benchmark LGs maintain a balanced and effective approach to service delivery and development outcomes, while utilizing budgetary resources in a highly efficient manner. Notably, the table illustrates a central principle of the DEA methodology: higher efficiency does not imply the lowest absolute spending, but rather the most effective conversion of inputs into desirable outputs (Cooper et al., 2011). In this sense, benchmark LGs stand out for their ability to generate strong development outcomes relative to their resource use.

Table 3: Overview of DEA input and output indicators across efficiency clusters and LG types

cluster	sample	*total_exp _pc*	*devel_index*	*high_edu_ attend (%)*	*waste_kg (pc)*	*int_acc (%)*	*vot_turn (%)*
		input	outputs				
1 – Benchmark	all	898	99.25	3.74	212	46.92	63.89
	cities	1,285	101.74	4.55	307	50.27	47.42
	mun	753	97.02	3.52	182	48.99	58.48
2 – Super efficient	all	798	95.12	3.50	236	45.39	50.45
	cities	792	98.40	4.18	267	47.88	44.87
	mun	728	92.43	3.15	218	40.69	53.96
3 – Moderate	all	768	93.53	3.11	190	43.08	50.38
	cities	1,082	98.19	3.94	217	46.07	43.76
	mun	753	92.55	2.88	178	42.03	50.18
4 – Low	all	1,033	93.49	2.97	170	40.96	48.51
	cities	1,593	98.04	3.26	237	41.97	44.03
	mun	1,006	92.46	2.81	159	40.19	49.59

Source: Author

Finally, It is important to emphasize that the higher average values of development-related outputs among benchmark units are not unexpected, as these indicators were directly used in the DEA efficiency assessment. Therefore, these findings should not be interpreted as evidence of a causal relationship, but rather as a confirmation that benchmark LGs tend to achieve better outcomes relative to their expenditure levels, which is precisely what defines their efficiency status within the model.

5. Conclusion and discussion

This study provides a comprehensive assessment of LG efficiency in the Slavonia region by applying a two-stage DEA model to 127 cities and municipalities. In the first stage, an input-oriented BCC model was used to evaluate relative efficiency under variable returns to scale. In the second stage, a super-efficiency model was applied to establish a full efficiency ranking, identify benchmark units, and enable subsequent clustering of LGs based on performance. The analysis was first conducted on the full sample of all LGs in Slavonia, and then separately for cities and for municipalities, allowing for structural differences between these two categories to be accounted for in the interpretation of efficiency patterns.

The analysis reveals that efficiency is not determined solely by LG type, size, or absolute spending, but by the ability to convert available financial resources into meaningful, multi-dimensional development outcomes. Benchmark LGs demonstrate that high performance is achievable even under structural and fiscal constraints. The municipalities of Čeminac, Klakar, and Punitovci emerge as particularly notable examples. Their ability to achieve and sustain benchmark status in both the full sample and the municipal-only analysis reveals that smaller, rural LGs can achieve outstanding results when expenditures are well-aligned with local needs and governance capacities. In addition, the City of Osijek – despite being the largest and most resource-endowed LG in the region – also appears as a benchmark unit in both the full sample and the city-only subset. While its inclusion may be less surprising given its scale and institutional capacity, it reinforces the internal validity of the efficiency model and suggests that even large urban LGs can maintain high levels of efficiency when resources are strategically managed.

Importantly, the findings confirm a key principle of DEA methodology: efficiency is not about minimizing spending, but about maximizing the impact of that spending. Benchmark units demonstrated the ability to generate stronger development outcomes – such as higher rates of tertiary level education attendance, enhanced economic performance, broader internet access, and greater voter turnout – relative to their budgetary inputs. These results align with the objectives of the SDGs, particularly those related to inclusive development, sustainability, digital infrastructure, and participatory governance.

By focusing on the local level within a single, structurally challenged region, this study fills a critical gap in Croatian efficiency research, which has traditionally emphasized county-level analysis. The approach provides a granular understanding of public sector performance and can support targeted, evidence-based interventions. Furthermore, it demonstrates the relevance and applicability of DEA in evaluating multidimensional community development outcomes at the local level.

These findings have several policy implications. First, benchmark LGs should be actively promoted as reference models in the design of capacity-building initiatives, peer learning networks, and development planning. National and regional authorities can use these cases to identify good practices and adapt them to other local contexts. Second, development funding – particularly from the EU structural and investment funds – should be more strategically aligned with performance indicators, incentivizing LGs to focus not only on funding absorption but on measurable developmental impact. Third, technical assistance and strategic planning support should be concentrated in low-performing LGs, where capacity gaps are most likely to hinder efficient resource utilization. Finally, this study reinforces the need for performance-based monitoring systems at the local level, which evaluate not only the volume of expenditures, but also the quality and sustainability of their outcomes.

This study is not without limitations. The selection of output indicators was constrained by data availability, focusing on those that are quantifiable and comparable across all LGs. As such, important qualitative aspects – such as service quality, citizen satisfaction, or administrative innovation – could not be captured. DEA results are also sensitive to variable selection and may reflect context-specific relationships that limit broader generalization. While the analysis offers valuable insights into one macro-region, findings may not be directly transferable to other parts of Croatia or different institutional settings. Future research could address these limitations by incorporating richer datasets, longitudinal analysis, or mixed-method approaches that triangulate efficiency scores with qualitative governance factors.

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REFERENCES

Ammons, D. N. (2020): ***Performance measurement for managing local government: Getting it right.*** Melvin & Leigh.

Andersen, P., & Petersen, N. C. (1993): ***A Procedure for Ranking Efficient Units in Data Envelopment Analysi***s. Management Science, *39*(10), 1261–1264. https://doi.org/10.1287/mnsc.39.10.1261

Balaguer-Coll, M. T., & Prior, D. (2009): ***Short- and long-term evaluation of efficiency and quality. An application to spanish municipalities.*** Applied Economics, *41*(23), 2991–3002. https://doi.org/10.1080/00036840701351923

Banker, R. D., Charnes, A., & Cooper, W. W. (1984): ***Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis.*** Management Science, *30*(9), 1078–1092. https://doi.org/10.1287/mnsc.30.9.1078

Charnes, A., Cooper, W. W., & Rhodes, E. J. (1978): ***Measuring the efficiency of decision making units.*** European Journal of Operational Research, *2*(6), 429–444. https://doi.org/10.1016/0377-2217(78)90138-8

Cooper, W. W., Seiford, L. M., & Zhu, J. (2011): ***Handbook on Data Envelopment Analysis.*** Springer New York, NY. https://doi.org/https://doi.org/10.1007/978-1-4419-6151-8

Croatian Bureau of Statistics. (2021): ***Population by school attendance and sex, by towns/municipalities, 2021 census.*** Retrieved from https://podaci.dzs.hr/en/statistics/population/census/ (accessed 12 November 2024)

Croatian Regulatory Authority for Network Industries. (2020): ***Access to the internet 2020, Zagreb: Croatian Regulatory Authority for Network Industries (HAKOM)***. Obtained on request.

Geys, B., & Moesen, W. (2009): ***Measuring Local Government Technical (In)Efficiency.*** Public Performance & Management Review, *32*(4), 499–513. https://doi.org/10.2753/pmr1530-9576320401

Gidion, D. K. (2023): ***Investigation of water utility efficiency features: production variables and the DEA model choices.*** Water Supply, *23*(4), 1700–1710. https://doi.org/10.2166/ws.2023.093

Hodžić, S., & Muharemović, A. (2019): ***Fiscal decentralization and efficiency of regional government in Croatia: A data envelopment analysis.*** Lex Localis, *17*(3), 453–470. https://doi.org/10.4335/17.3.453-470(2019)

Jardas Antonić, J., & Šegota, A. (2017): ***Measuring performance of local e-government in the republic of Croatia using data envelopment analysis***. Problems and Perspectives in Management, *10*, 35–45. Retrieved from https://api.semanticscholar.org/CorpusID:65080402

Lazović-Pita, L., & Šćeta, L. (2021): ***A Stochastic Frontier Approach to Measuring Inefficiency of Local Communities in Bosnia and Herzegovina.*** South East European Journal of Economics and Business, *16*(1), 18–29. https://doi.org/10.2478/jeb-2021-0002

Ministry of Environmental Protection and Green Transition. (2023): ***Izvješće o komunalnom otpadu za 2023. godinu***. Retrieved from https://isgo-portal.mingor.hr/sites/default/files/izvjesca/2024-10/Izvješće o komunalnom otpadu za 2023 - FV.pdf (accessed 15 December 2024)

Ministry of Finance. (2023): ***Financijski izvještaji JLP(R)S; PR-RAS i RAS-funkc za razdoblje 2019. - 2023.*** Retrieved from https://mfin.gov.hr/istaknute-teme/lokalna-samouprava/financijski-izvjestaji-jlp-r-s/203 (accessed 20 January 2025)

Ministry of Regional Development and EU Funds. (2024): ***Vrijednost indeksa razvijenosti i pokazatelja za izračun indeksa razvijenosti 2024.*** Retrieved from https://razvoj.gov.hr/o-ministarstvu/djelokrug-1939/regionalni-razvoj/indeks-razvijenosti/vrijednost-indeksa-razvijenosti-i-pokazatelja-za-izracun-indeksa-razvijenosti-2024/5508 (accessed 25 January 2025)

Nikolov, M. (2013): ***Cost Efficiency of Municipalities in Service Delivery: Does Ethnic Fragmentation Matter?*** Lex Localis.

Pevcin, P. (2013): ***Costs and Efficiency of Municipalities in Slovenia***. *Lex Localis*, *11*(3). Retrieved from https://lex-localis.org/index.php/LexLocalis/article/view/11.3.531-543(2013)

Rabar, D. (2013): ***Assessment of Regional Efficiency in Croatia Using Data Envelopment Analysis.*** Croatian Operational Research Review, *4*(1), 76–88.

Ríos, A.-M., Guillamón, M.-D., Cifuentes-Faura, J., & Benito, B. (2022): ***Efficiency and sustainability in municipal social policies***. Social Policy & Administration, *56*(7), 1103–1118. https://doi.org/https://doi.org/10.1111/spol.12843

Šegota, A., Jardas Antonić, J., & Rakamarić Šegić, M. (2013): ***Non-Parametric Approach in Efficiency Analysis of Local E-Government in Croatia.*** In 2nd International Conference "Economic System of The European Union and Accession of Bosnia & Herzegovina."

Šehić, E., Osmanković, J., & Galić, M. (2013): ***Economic and Functional Efficiency of Territorial Organization of Bosnia and Herzegovina.*** In Local Economic and Infrastructure Development of SEE in the Context of EU Accession (pp. 171–180). Sarajevo: Proceedings of Academy of Sciences & Arts of Bosnia & Herzegovina. https://doi.org/10.5644/pi2013-153-09

Škuflić, L., Rabar, D., & Šokčević, S. (2010): ***Assessment of the efficiency of Croatian counties using Data envelopment analysis***. Ekonomska Istraživanja, *23*(2), 88–101.

Slijepčević, S. (2019): ***Measuring Efficiency at the Regional Level: A Data Envelopment Analysis Approach***. Lex Localis, 17(3), 679–696. https://doi.org/10.4335/17.3.679-696(2019)

Šmaguc, T., & Vuković, K. (2018): ***Assessment of the efficiency of investment in entrepreneurial zones in Croatia using data envelopment analysis***. In Proceedings of the IISES Annual Conference, Sevilla, Spain. Sevilla: Prag: International Institute of Social and Economic Sciences.

Staníčková, M., & Melecky, L. (2012): ***Assessment of efficiency in Visegrad countries and regions using DEA models.*** Ekonomická Revue – Central European Review of Economic Issues, *15*, 145–156. https://doi.org/10.7327/cerei.2012.09.02

State Electoral Commission. (2021): ***Arhiva izbora Republike Hrvatske; Lokalni izbori 2013., 2017. i 2021. Zagreb***. Retrieved from https://www.izbori.hr/arhiva-izbora/index.html#/app/home (accessed 15 December 2024)

Wagner, J. M., & Shimshak, D. G. (2007): ***Stepwise selection of variables in data envelopment analysis: Procedures and managerial perspectives.*** European Journal of Operational Research, *180*(1), 57–67. https://doi.org/https://doi.org/10.1016/j.ejor.2006.02.048

World Bank. (2019): ***Growth and Jobs in Slavonia, Baranja and Srijem: Rapid Diagnostics.*** Retrieved from https://documents1.worldbank.org/curated/en/116851593152107904/pdf/Growth-and-Jobs-in-Slavonia-Baranja-and-Srijem-Rapid-Diagnostics.pdf

APPENDIX

Table A1: DEA results – all LGs

LG name	LG type (c-city; m-municipality)	Efficiency level	Efficiency cluster
Čeminac	m	Benchmark	1 - Benchmark
Klakar	m	Benchmark	1 - Benchmark
Punitovci	m	Benchmark	1 - Benchmark
Osijek	c	Benchmark	1 - Benchmark
Borovo	m	4.9749	2 - Super efficient
Antunovac	m	3.4331	2 - Super efficient
Virovitica	c	2.9471	2 - Super efficient
Đakovo	c	1.8154	2 - Super efficient
Vinkovci	c	1.7391	2 - Super efficient
Negoslavci	m	1.4655	2 - Super efficient
Levanjska Varoš	m	1.3418	2 - Super efficient
Jarmina	m	1.3410	2 - Super efficient
Drenje	m	1.2159	2 - Super efficient
Pitomača	m	1.1882	2 - Super efficient
Čepin	m	1.1642	2 - Super efficient
Vuka	m	1.1087	2 - Super efficient
Gornja Vrba	m	1.1039	2 - Super efficient
Štitar	m	1.1011	2 - Super efficient
Bilje	m	1.0858	2 - Super efficient
Mikleuš	m	1.0760	2 - Super efficient
Podravska Moslavina	m	1.0724	2 - Super efficient
Dragalić	m	1.0466	2 - Super efficient
Zdenci	m	1.0373	2 - Super efficient
Požega	c	1.0316	2 - Super efficient
Vođinci	m	1.0037	2 - Super efficient
Stara Gradiška	m	0.9986	3 - Moderate
Nuštar	m	0.9764	3 - Moderate
Donja Motičina	m	0.9678	3 - Moderate
Županja	c	0.9552	3 - Moderate
Bogdanovci	m	0.9422	3 - Moderate
Jakšić	m	0.9388	3 - Moderate
Feričanci	m	0.9193	3 - Moderate
Bukovlje	m	0.9125	3 - Moderate
Viškovci	m	0.9098	3 - Moderate
Donji Miholjac	c	0.9092	3 - Moderate
Oprisavci	m	0.9071	3 - Moderate
Lovas	m	0.8929	3 - Moderate
Tompojevci	m	0.8842	3 - Moderate
Bošnjaci	m	0.8762	3 - Moderate
Trnava	m	0.8687	3 - Moderate
Ivankovo	m	0.8327	3 - Moderate
Slavonski Brod	c	0.8101	3 - Moderate
Gradina	m	0.7920	3 - Moderate
Davor	m	0.7908	3 - Moderate
Gornji Bogićevci	m	0.7906	3 - Moderate
Gorjani	m	0.7870	3 - Moderate
Velika Kopanica	m	0.7846	3 - Moderate

LG name	LG type (c-city; m-municipality)	Efficiency level	Efficiency cluster
Tordinci	m	0.7759	3 - Moderate
Marijanci	m	0.7706	3 - Moderate
Crnac	m	0.7649	3 - Moderate
Lukač	m	0.7642	3 - Moderate
Petlovac	m	0.7607	3 - Moderate
Podgorač	m	0.7604	3 - Moderate
Đurđenovac	m	0.7348	3 - Moderate
Gundinci	m	0.7324	3 - Moderate
Vrbje	m	0.7289	3 - Moderate
Trpinja	m	0.7199	3 - Moderate
Slatina	c	0.7040	3 - Moderate
Čačinci	m	0.6965	3 - Moderate
Donji Andrijevci	m	0.6822	3 - Moderate
Suhopolje	m	0.6779	3 - Moderate
Viljevo	m	0.6603	3 - Moderate
Darda	m	0.6574	3 - Moderate
Našice	c	0.6552	3 - Moderate
Okučani	m	0.6507	3 - Moderate
Valpovo	c	0.6505	3 - Moderate
Vladislavci	m	0.6479	3 - Moderate
Petrijevci	m	0.6387	3 - Moderate
Sibinj	m	0.6325	3 - Moderate
Sikirevci	m	0.6321	3 - Moderate
Velika	m	0.6311	3 - Moderate
Tovarnik	m	0.6311	3 - Moderate
Ernestinovo	m	0.6289	3 - Moderate
Stari Mikanovci	m	0.6213	3 - Moderate
Markušica	m	0.6155	3 - Moderate
Gunja	m	0.6152	3 - Moderate
Gradište	m	0.6052	3 - Moderate
Nova Gradiška	c	0.6026	3 - Moderate
Slavonski Šamac	m	0.5995	4 - Low
Staro Petrovo Selo	m	0.5989	4 - Low
Špišić Bukovica	m	0.5984	4 - Low
Rešetari	m	0.5962	4 - Low
Nova Kapela	m	0.5953	4 - Low
Popovac	m	0.5867	4 - Low
Belišće	c	0.5861	4 - Low
Kaptol	m	0.5830	4 - Low
Bizovac	m	0.5826	4 - Low
Šodolovci	m	0.5813	4 - Low
Sopje	m	0.5601	4 - Low
Garčin	m	0.5601	4 - Low
Erdut	m	0.5586	4 - Low
Čađavica	m	0.5582	4 - Low
Satnica Đakovačka	m	0.5545	4 - Low
Otok	c	0.5495	4 - Low
Draž	m	0.5469	4 - Low
Brestovac	m	0.5452	4 - Low
Voćin	m	0.5389	4 - Low

LG name	LG type (c-city; m-municipality)	Efficiency level	Efficiency cluster
Čaglin	m	0.5361	4 - Low
Semeljci	m	0.5354	4 - Low
Koška	m	0.5293	4 - Low
Oriovac	m	0.5277	4 - Low
Cerna	m	0.5165	4 - Low
Jagodnjak	m	0.5143	4 - Low
Andrijaševci	m	0.5018	4 - Low
Podcrkavlje	m	0.4981	4 - Low
Cernik	m	0.4937	4 - Low
Privlaka	m	0.4887	4 - Low
Vukovar	c	0.4869	4 - Low
Bebrina	m	0.4734	4 - Low
Pleternica	c	0.4678	4 - Low
Pakrac	c	0.4594	4 - Low
Drenovci	m	0.4557	4 - Low
Nova Bukovica	m	0.4552	4 - Low
Kutjevo	c	0.4250	4 - Low
Vrpolje	m	0.4240	4 - Low
Orahovica	c	0.4186	4 - Low
Kneževi Vinogradi	m	0.4174	4 - Low
Nijemci	m	0.4098	4 - Low
Strizivojna	m	0.3794	4 - Low
Stari Jankovci	m	0.3715	4 - Low
Vrbanja	m	0.3709	4 - Low
Beli Manastir	c	0.3641	4 - Low
Babina Greda	m	0.3604	4 - Low
Magadenovac	m	0.3556	4 - Low
Ilok	c	0.2973	4 - Low
Lipik	c	0.2516	4 - Low
Brodski Stupnik	m	0.2091	4 - Low

Source: Author

Table A2: DEA results – cities

City	Efficiency level	Efficiency cluster
Orahovica	Benchmark	1 - Benchmark
Osijek	Benchmark	1 - Benchmark
Otok	Benchmark	1 - Benchmark
Vinkovci	Benchmark	1 - Benchmark
Virovitica	Benchmark	1 - Benchmark
Đakovo	1.8154	2 - Super efficient
Donji Miholjac	1.7002	2 - Super efficient
Županja	1.4316	2 - Super efficient
Slatina	1.2561	2 - Super efficient
Kutjevo	1.2419	2 - Super efficient
Valpovo	1.2185	2 - Super efficient
Požega	1.1377	2 - Super efficient
Pakrac	0.9514	3 - Moderate
Nova Gradiška	0.9067	3 - Moderate

City	Efficiency level	Efficiency cluster
Našice	0.8956	3 - Moderate
Slavonski Brod	0.8158	3 - Moderate
Ilok	0.7933	3 - Moderate
Pleternica	0.7491	3 - Moderate
Belišće	0.6677	3 - Moderate
Lipik	0.5595	4 - Low
Vukovar	0.5224	4 - Low
Beli Manastir	0.4865	4 - Low

Source: Author

Table A3: DEA results – municipalities

Municipality	Efficiency level	Efficiency cluster
Antunovac	Benchmark	1 - Benchmark
Bilje	Benchmark	1 - Benchmark
Borovo	Benchmark	1 - Benchmark
Čeminac	Benchmark	1 - Benchmark
Čepin	Benchmark	1 - Benchmark
Ivankovo	Benchmark	1 - Benchmark
Klakar	Benchmark	1 - Benchmark
Pitomača	Benchmark	1 - Benchmark
Punitovci	Benchmark	1 - Benchmark
Nuštar	1.6262	2 - Super efficient
Negoslavci	1.4655	2 - Super efficient
Levanjska Varoš	1.3418	2 - Super efficient
Jarmina	1.3410	2 - Super efficient
Drenje	1.2986	2 - Super efficient
Gornja Vrba	1.1151	2 - Super efficient
Vuka	1.1087	2 - Super efficient
Štitar	1.1011	2 - Super efficient
Mikleuš	1.0760	2 - Super efficient
Podravska Moslavina	1.0724	2 - Super efficient
Zdenci	1.0685	2 - Super efficient
Dragalić	1.0466	2 - Super efficient
Vođinci	1.0037	2 - Super efficient
Stara Gradiška	0.9986	3 - Moderate
Jakšić	0.9883	3 - Moderate
Donja Motičina	0.9678	3 - Moderate
Bogdanovci	0.9422	3 - Moderate
Bukovlje	0.9386	3 - Moderate
Feričanci	0.9193	3 - Moderate
Bošnjaci	0.9122	3 - Moderate
Viškovci	0.9098	3 - Moderate
Oprisavci	0.9071	3 - Moderate
Lovas	0.8929	3 - Moderate

Municipality	Efficiency level	Efficiency cluster
Tompojevci	0.8842	3 - Moderate
Trnava	0.8687	3 - Moderate
Davor	0.8677	3 - Moderate
Darda	0.8440	3 - Moderate
Đurđenovac	0.8385	3 - Moderate
Trpinja	0.8242	3 - Moderate
Gradina	0.7920	3 - Moderate
Gornji Bogićevci	0.7906	3 - Moderate
Gorjani	0.7870	3 - Moderate
Velika Kopanica	0.7846	3 - Moderate
Tordinci	0.7759	3 - Moderate
Lukač	0.7758	3 - Moderate
Suhopolje	0.7717	3 - Moderate
Marijanci	0.7706	3 - Moderate
Crnac	0.7649	3 - Moderate
Petlovac	0.7607	3 - Moderate
Podgorač	0.7604	3 - Moderate
Erdut	0.7437	3 - Moderate
Gundinci	0.7324	3 - Moderate
Vrbje	0.7289	3 - Moderate
Čačinci	0.6965	3 - Moderate
Velika	0.6956	3 - Moderate
Donji Andrijevci	0.6897	3 - Moderate
Viljevo	0.6603	3 - Moderate
Tovarnik	0.6595	3 - Moderate
Sibinj	0.6518	3 - Moderate
Okučani	0.6507	3 - Moderate
Vladislavci	0.6479	3 - Moderate
Petrijevci	0.6427	3 - Moderate
Gradište	0.6351	3 - Moderate
Gunja	0.6325	3 - Moderate
Rešetari	0.6324	3 - Moderate
Sikirevci	0.6321	3 - Moderate
Ernestinovo	0.6300	3 - Moderate
Stari Mikanovci	0.6293	3 - Moderate
Staro Petrovo Selo	0.6168	3 - Moderate
Markušica	0.6155	3 - Moderate
Špišić Bukovica	0.6145	3 - Moderate
Bizovac	0.6064	3 - Moderate
Slavonski Šamac	0.5995	4 - Low
Nova Kapela	0.5979	4 - Low
Garčin	0.5914	4 - Low
Popovac	0.5867	4 - Low
Kaptol	0.5830	4 - Low
Šodolovci	0.5813	4 - Low
Oriovac	0.5680	4 - Low

Municipality	Efficiency level	Efficiency cluster
Sopje	0.5601	4 - Low
Čađavica	0.5582	4 - Low
Satnica Đakovačka	0.5545	4 - Low
Cerna	0.5524	4 - Low
Draž	0.5469	4 - Low
Brestovac	0.5452	4 - Low
Semeljci	0.5426	4 - Low
Voćin	0.5389	4 - Low
Čaglin	0.5361	4 - Low
Koška	0.5308	4 - Low
Andrijaševci	0.5303	4 - Low
Cernik	0.5224	4 - Low
Jagodnjak	0.5143	4 - Low
Privlaka	0.5025	4 - Low
Podcrkavlje	0.4981	4 - Low
Drenovci	0.4927	4 - Low
Bebrina	0.4734	4 - Low
Nijemci	0.4565	4 - Low
Nova Bukovica	0.4552	4 - Low
Kneževi Vinogradi	0.4457	4 - Low
Vrpolje	0.4289	4 - Low
Stari Jankovci	0.3895	4 - Low
Strizivojna	0.3794	4 - Low
Vrbanja	0.3750	4 - Low
Babina Greda	0.3618	4 - Low
Magadenovac	0.3556	4 - Low
Brodski Stupnik	0.2091	4 - Low

Source: Author

A scientific paper

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BRIDGING THE GAP TO I4.0: READINESS OF THE DANUBE REGION WOOD INDUSTRY

ABSTRACT

Industry 4.0 (I4.0) is fundamentally transforming manufacturing by integrating advanced digital technologies, automation, and data exchange, thereby enhancing industrial innovation, efficiency, and sustainability. The wood industry, as a cornerstone of the Danube Region's economy and a key player in the circular bioeconomy, faces unique challenges and opportunities in this transition. This study addresses a critical research gap by examining the readiness of the Danube Region's wood industry for the adoption of I4.0 standards, with a particular focus on Croatia. The research is significant for both science and practice: it provides empirical insights into stakeholder capacities, involvement, and perceptions of I4.0, and identifies actionable strategies for bridging the digital divide across countries and sectors. Using a standardized stakeholder assessment methodology, the study analyses 170 organizations from 11 countries, categorizing stakeholders by influence, knowledge, interest, and support for I4.0 transformation. Data on Lean, Digital, and Green transformations, collected via structured questionnaires, reveal regional capacities and barriers to I4.0 adoption. The findings highlight that Croatia has strong academic potential with significant technical expertise. However, collaboration between academia and industry remains limited, placing the country at a relative disadvantage compared to other regions. While regional development agencies and industrial clusters show enthusiasm for transformation, they often lack the necessary resources, training, and tools to drive change effectively. Policymakers are generally supportive, but sustained engagement is required to align project initiatives with broader national strategies. The study concludes that investments in digital infrastructure, targeted education-especially for micro and small enterprises-and strengthened public-private

partnerships are essential for accelerating I4.0 adoption and fostering sustainable, innovation-driven development in the Danube Region.

Key words: *I4.0, Digitalization, Wood industry, Innovation.*

1. Introduction

Industry 4.0, recognized as the Fourth Industrial Revolution, introduces a new paradigm of digital, autonomous, and decentralized control in manufacturing systems. This shift emphasizes smart manufacturing through digitization, collaboration, and automation, resulting in significant social, economic, and environmental benefits such as resource optimization, reduced environmental impact, and new employment opportunities (Hecklau et al., 2016, pp. 2–5; Sahal et al., 2021, p. 8).

The wood industry holds a strategic role in the Danube Region and is a key contributor to the circular bioeconomy and regional development. However, the readiness for I4.0 transformation varies significantly across different sectors in the Danube Region. While Western countries such as Germany and Austria exhibit strong digital infrastructure and advanced workforce skills (Gallina et al., 2019, pp. 4–5), Eastern European countries face persistent barriers, including limited financial resources, skills shortages, and fragmented knowledge (The World Bank, 2023, pp. 2–14; Maravić et al., 2022a, pp. 4–5; Zavarská, 2024, pp. 9–22).

These gaps are especially evident in the wood sector, which remains rooted in traditional practices in many parts of the region, especially where forest resources are a key natural asset (Borovics & Király, 2023, p. 1; Kropivšek et al., 2019, pp. 1, 8). Overcoming these challenges requires training and reskilling programs to equip workers with digital competencies (Li, 2022, p. 8), as well as targeted policies that support sustainable production (European Commission, 2021, pp. 3–5).

This study aims to fill a notable gap in the literature on I4.0 readiness in the wood sector—especially in Central and Eastern Europe—where comparative analyses are lacking. Practically, it provides valuable insights for industry stakeholders, policymakers, and regional development actors seeking to improve competitiveness, sustainability, and resilience.

Focusing on the Danube Region, with a specific emphasis on Croatia, the study aims to: (1) map and analyse key stakeholders; (2) assess organizational readiness across Lean, Digital, and Green dimensions using the CULIS methodology; and (3) conduct a comparative analysis across Danube countries. This multi-dimensional and transnational approach addresses regional differences and the fragmented nature of existing research, offering actionable recommendations aligned with broader European sustainability strategies.

Given the wood industry's importance for regional economic development and bioeconomy goals, understanding its I4.0 readiness is both timely and strategically relevant. The core research problem is the lack of comparative, sector-specific insights into I4.0 readiness in the Danube Region's wood sector, where industrial transformation remains uneven.

The research is framed within a multi-dimensional theoretical framework combining stakeholder theory (Brugha & Varvasovszky, 2000, p. 1) and the CULIS methodology, integrating Lean, Digital, and Green transformation dimensions. This framework enables a

comprehensive assessment of organizational readiness while identifying key actors and their roles in shaping transformation dynamics.

To guide the investigation, the following research questions are posed:

1. Who are the key stakeholders in the wood industry's I4.0 transformation in the Danube Region, and what roles do they play?

2. To what extent are wood sector organizations prepared for I4.0 adoption across Lean, Digital, and Green dimensions?

3. What are the main regional differences in I4.0 readiness within the Danube Region, focusing on Croatia?

4. What policy and strategic measures can accelerate the digital transformation of the wood sector?

By answering these questions, the study contributes to both theory and practice by filling empirical gaps, supporting evidence-based policymaking, and strengthening regional strategies for sustainable industrial development.

2. Literature Review

Digital Transformation in the Wood Industry: A Regional Perspective

The digital transformation of the wood industry has attracted significant attention across Europe, particularly in the Danube region. Research highlights varying levels of technological adoption and challenges shaped by economic, institutional, and geographic factors.

Adoption Patterns in Slovenia and Croatia

In Slovenia, 67% of medium and large enterprises use digitalization elements, but micro-enterprises progress slowly due to high costs and limited government support (Kropivšek & Grošelj, 2020, pp. 141–146). Cloud computing and smart applications significantly impact Slovenian enterprises, whereas Croatia shows slower progress in adopting advanced technologies like Artificial Intelligence (AI). Mladineo et al. note that Croatian digital transformation is evolving and builds on previous studies emphasizing lean tools for cost reduction, quality improvement, and resource optimization (Mladineo et al., 2024, p. 9).

For instance, Hegedić et al. emphasized the importance of a tailored approach using external consultants, focusing on economic indicators and waste reduction, although the use of life cycle assessments (LCA) was limited (Hegedić et al., 2018, pp. 21–39). Maravić et al. provided more recent insights, showing that 33.7% of Croatian companies had just begun digitalization, 42.2% were partially implemented, and 20% were highly digitalized, primarily using cloud technologies and smart devices (Maravić et al., 2022a, p. 45). Their study also noted a gradual shift toward AI and Internet of Things (IoT) adoption, aligning with global standards and driven by motivations such as reputation and efficiency. However, the barriers have evolved from technical to more complex organizational and cultural challenges, highlighting the versatile nature of digital transformation.

Challenges in Central and Eastern Europe

Austria is exploring I4.0 technologies in its forestry and wood sector, though specific strategies for the timber sector are not well-documented (Hölzl et al., 2019, p. 8). In Hungary, small and medium-sized enterprises (SMEs) face constraints due to limited internal resources, such as human capital and financial resources, and external factors like market failures and intense competition, but government initiatives like "I4.0 Sample Factories" and the "Digital Welfare Financial Programme" offer support (Endrodi-Kovács & Stukovszky, 2022, pp. 139, 146).

Romania benefits from abundant raw materials, low labour costs, and high technical qualifications while Bulgaria struggles with low labour productivity-over four times lower than the EU average-highlighting the need for digital transformation to enhance efficiency (Grzegorzewska & Sedliačiková, 2021, p. 13).

Across the region, foreign direct investment (FDI) plays a pivotal role in economic development, particularly in IT and software services. Romania, Hungary, Czechia, and Bulgaria have been top recipients of FDI projects in this sector, with Romania experiencing rapid IT sector growth since 2014 (Zavarská, 2024, pp. 17–18). Although digital readiness differs from country to country, FDI consistently helps drive the adoption of new technologies.

Institutional and Educational Barriers

In Ukraine, the wood processing and furniture manufacturing sector faces challenges related to mechanization, automation, and computerization, which increasingly require specific skills with high technical and ICT proficiency. This poses a challenge for vocational education and training (VET) systems to provide these skills. Moreover, English language skills are a prerequisite for most digital learning, yet the current allocation of hours for English language instruction is insufficient, and there is a need for upskilling teachers' knowledge in professional terminology (Mereuta et al., 2021, pp. 5–8).

Moldova faces similar challenges in digital transformation, primarily due to limited institutional capacities for promoting research and innovation. However, supporting the internationalization of Moldovan SMEs through digital transformation could increase their competitiveness and market access, aligning with broader regional efforts to enhance economic development (United Nations Industrial Development Organization, 2020, pp. 9, 30).

Regional Collaboration and Infrastructure

Croatia's geographic position offers unique opportunities for collaboration with non-EU countries like Serbia and Bosnia and Herzegovina, as part of a broader regional effort to improve cohesion among developed and less developed countries in the Danube Region, which is crucial for enhancing competitiveness and cooperation (Lianu & Gudei, 2017, p. 249).

Croatia's participation in European Digital Infrastructure Consortiums (EDICs), which involve cross-country collaboration, demonstrates its commitment to regional digital initiatives, facilitating knowledge sharing with non-EU countries and fostering economic growth and sustainable development in the region (European Commission, 2024, p. 28). Hecklau et al. emphasize the development of competencies for managing big data and cybersecurity. Since then, the focus has broadened to a more holistic approach that emphasizes collaboration among academia, industry, and non-governmental organizations (NGOs). Their study also underscores

the need to attract a skilled workforce, promote ongoing education, and strategically coordinate stakeholder groups to achieve long-term sustainability (*DRWO4.0 Project Website*, n.d.; Hecklau et al., 2016, pp. 1–6).

Research Gaps and This Study's Contribution

Although prior work effectively maps regional disparities and the role of FDI, few studies holistically examine the institutional, economic, and educational drivers of digitalization in the wood industry. This paper addresses this gap by exploring synergies between lean management, green practices, and I4.0 adoption, with special emphasis on stakeholder collaboration and policy frameworks to provide a comprehensive understanding of transformation dynamics in the Danube region.

3. Methodology

The methodological approach addresses key aspects of wood industry transformation towards I4.0 standards through three main components: stakeholder mapping, assessment of transformation capacities, and comparative analysis of Danube region countries. The study, conducted over 4 months from June 2024 until the end of September 2024, involved 170 organizations from 11 countries: Croatia, Austria, Slovenia, Hungary, Bosnia and Herzegovina, Serbia, Romania, Bulgaria, Moldova, Czech Republic, and Ukraine —out of a total of 314 mapped stakeholders (Table 1). These organizations were selected based on their specific roles in wood sector and their potential to adopt I4.0 technologies.

Table 1: Mapped Stakeholders by Country

No	Country	Total
1	Croatia	55
2	Bulgaria	45
3	Moldova	42
4	Ukraine	32
5	Czech Republic	30
6	Serbia	29
7	Slovenia	19
8	Hungary	19
9	Bosnia and Herzegovina	17
10	Romania	16
11	Austria	10
	Total:	314

Source: DRWO4.0 Project Website, n.d.

A special focus was placed on the analysis of four key categories:

1. **Power of Influence**
   Stakeholders were grouped by engagement and influence:
   1. **Key Players**
      Stakeholders with significant influence requiring regular consultation and active involvement in decision-making.
   2. **Meet Their Needs**

Stakeholders with high interest but lower influence, prioritized for engagement efforts to elevate their role.

3. **Show Consideration**
   Stakeholders with influence but moderate interest, engaged through low-risk communication to maintain advocacy potential.
4. **Least Important**
   Stakeholders requiring minimal engagement, managed via general updates (e.g., newsletters, social media).

2. **Level of Knowledge About the Issue**
   The level of expertise and understanding about the problem of low application of forest-based industry standards was evaluated, along with the stakeholders' readiness to apply existing knowledge in the context of transformation. Stakeholders were classified from uninformed to experts.

3. **Stakeholder Interest**
   The degree of engagement and interest in participating in the project was analysed. Categories included least interested, slightly interested, moderately interested, interested and stakeholders with high interest and motivation to actively participate.

4. **Level of Support**
   The level of support stakeholders provide for the transformation of the forest-based industry towards I4.0 was estimated, ranging from actively opposed to actively supportive.

Table 2: Template for Stakeholder Mapping

Mapped stakeholders per country							
Institution	Name of the Person (responsible person/ contact person)	Stakeholder Interest (1-5; 1=highest interest; 5=least interested)	Power of Influence (Key player; Meet their needs; Show consideration; Least important)	Level of Knowledge About the Issue (1= Uninformed 2=Familiar 3=Expert)	Level of support (1=Actively opposed; 2=Somewhat opposed; 3=Neutral/ undecided; 4=Somewhat supportive; 5=Actively supportive)	Possible Strategies for Engaging Stakeholder	Additional Stakeholders Identified by this Source

Source: DRWO4.0 Project Website, n.d.

In the first phase of the research, stakeholder mapping was conducted using a standard methodology for stakeholder mapping, considering their ability to contribute to the success of the project and their involvement in I4.0-related issues (Table 2). This phase involved desk and field research, and communication with local and regional stakeholders, focusing on identifying key stakeholders and categorizing them by: their interest in the project (rated from 1 to 5, where 1 represents the highest interest), their power of influence (categorized as "Key Player", "Meet their Needs", "Show Consideration," or "Least Important"), their level of knowledge about the issue (from "Uninformed" to "Expert"), and their level of support (ranging from "Actively

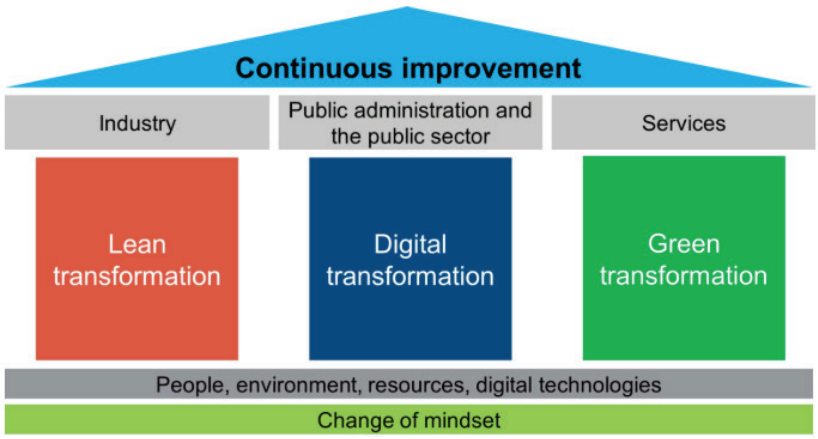
Opposed" to "Actively Supportive"). These categories were developed by synthesizing commonly used stakeholder analysis templates.

Project partners were tasked with completing the template, which also included information such as the institution's name, the responsible person's name, potential strategies for stakeholder engagement, and additional stakeholders identified through this process (Table 2). The mapped stakeholders included private companies, academic institutions, government agencies, clusters, and NGOs, providing key insights into the current state of wood industry in the Danube region according to I4.0 standards.

In the second phase, stakeholder readiness was assessed using a structured questionnaire grounded in the CULIS methodology. CULIS (Continuous Lean-Digital-Green Sustainable Transformation) is a comprehensive strategy that guides organizations through the adoption of Industry 4.0 by integrating Lean, Digital, and Green transformation dimensions. At its core, CULIS emphasizes the pivotal role of human capital and its interaction with the environment. (Biondić et al., 2022, pp. 2–3).

The methodology employs specific key performance indicators (KPIs) for each transformation dimension, enabling objective measurement of progress. The CULIS approach systematically addresses transformation across multiple organizational levels (country, region, enterprise, and individual), providing a structured framework that has demonstrated efficacy in transforming entire industrial sectors (Biondić et al., 2022, pp. 2–3) (Figure 1).

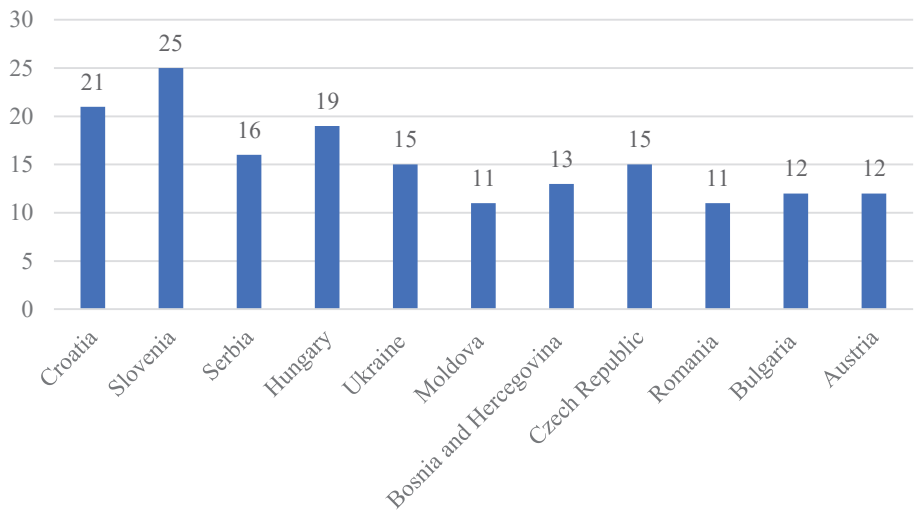
Figure 1: CULIS platform for continuous growth and sustainable development



Source: Biondić et al., 2022, p. 3

The questionnaire enabled the classification of participants into micro, small, medium, and large enterprises. As a result, the analysis considers both overall scores and scores categorized by company
size within the region and specific countries. The questionnaire was completed by 170 institutions from Croatia (21), Slovenia (25), Serbia (16), Hungary (19), Ukraine (15), Moldova (11), Bosnia and Herzegovina (13), Czech Republic (15), Romania (11), Bulgaria (12), and Austria (12). (Graph 1).

Graph 1: Completed questionnaires by the countries in Danube region



Source: DRWO4.0 Project Website, n.d

The questionnaire examined three key dimensions of the CULIS methodology (Figure 1):

1. **Lean manufacturing**: Assessed through 19 key questions evaluating organizations' waste reduction practices, resource efficiency, and continuous improvement processes. Fundamental Lean tools—such as 5S, Value Stream Mapping, Kaizen, SMED, and Visual Management—play a key role in process standardization and continuous improvement. (Biondić et al., 2022, pp. 1–4)
2. **Digitalization**: Measured via 15 targeted questions examining the integration of technologies such as IoT, AI, and cloud computing in business operations to enhance automation and data-driven decision-making. (Biondić et al., 2022, pp. 1–4)
3. **Green manufacturing**: Evaluated through 10 questions focusing on sustainable production practices, use of renewable energy sources, and resource management effectiveness. (Biondić et al., 2022, pp. 1–4)

The Assessment was conducted using a Likert scale from 1 to 5, where descriptive ratings of 1, 3, and 5 facilitated readiness evaluation, while scores of 2 and 4 allowed for greater precision.

The third phase examined the implementation status of I4.0 technologies across Danube region countries through comparative analysis. Using quantitative methods, the research evaluated key indicators including technological infrastructure, legal frameworks, industry adoption levels, and educational programs. This approach identified regional best practices and collaboration opportunities, informing policy recommendations for both national and regional development strategies. The resulting data were visualized through tables and graphs to facilitate interpretation of key findings.

4. Results

In the initial phase of the research, stakeholder mapping was conducted across each participating country to identify key actors relevant to technological advancement in the forest-based industry. The number of mapped stakeholders by country was as follows: Croatia (55),

Bulgaria (45), Moldova (42), Ukraine (32), Czech Republic (30), Serbia (29), Slovenia (19), Hungary (19), Bosnia and Herzegovina (17), Romania (16), and Austria (10).

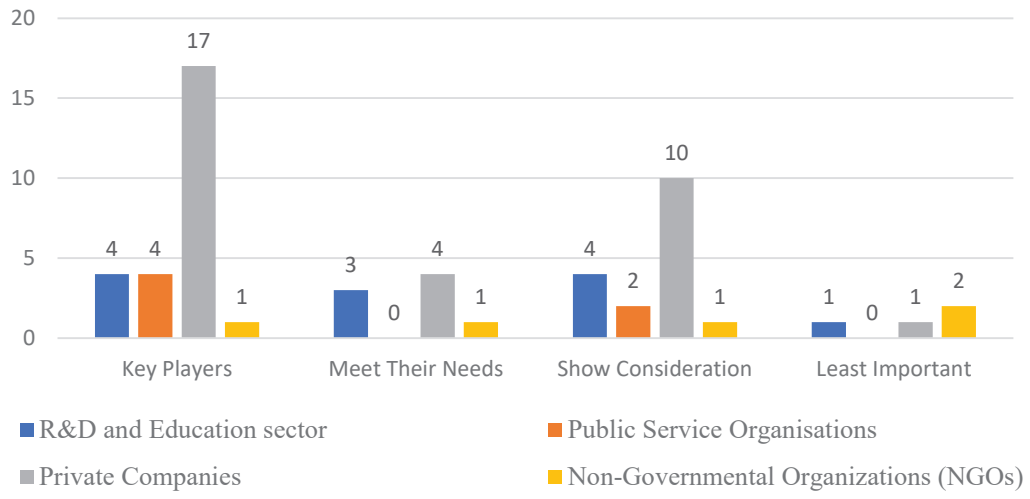
Given the strategic importance of the wood sector in national development, as well as the relatively high number of mapped stakeholders, this paper places particular focus on the results from Croatia.

In the Croatian context, the mapped stakeholders included 12 institutions from the R&D and education sector, 6 public service organizations, 5 NGOs, and 32 private companies.

Stakeholders were categorized based on influence, knowledge about the problem of low application of forest-based industry standards, interest in the project, and level of support for the transformation of the forest-based industry towards I4.0. For each of these categories, graphical representations were created, clearly illustrating the distribution of stakeholders, enabling a deeper understanding of their positions and attitudes.

Graph 2 illustrates the distribution of stakeholder influence across four categories: Key Players, Meet Their Needs, Show Consideration, and Least Important. Private companies overwhelmingly dominate the "Key Players" group, accounting for 17 out of 26 stakeholders, while the R&D and education sector and public service organizations each contribute 4, and NGOs 1. In the "Meet Their Needs" category, private companies and the R&D sector are most represented, with 4 and 3 stakeholders respectively. The "Show Consideration" group is again led by private companies (10), followed by the R&D sector (4) and public service organizations (2). NGOs have a modest presence across all categories, with the highest representation (2) in the "Least Important" group (Graph 2).

Graph 2: Power of influence by sector

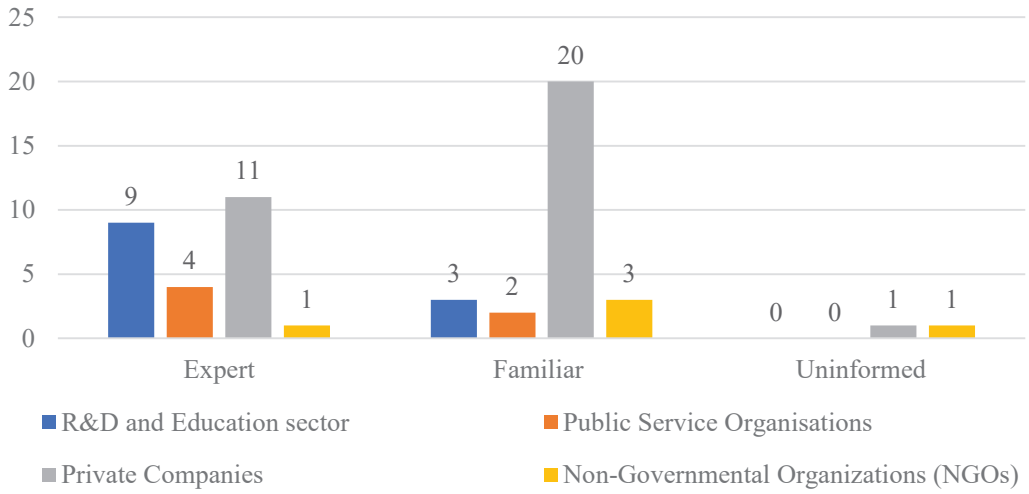


Source: DRWO4.0 Project Website, n.d.

Graph 3 presents the distribution of stakeholders' knowledge levels regarding the low adoption of forest-based industry standards, categorized as Expert, Familiar, or Uninformed. Private companies account for the largest share of stakeholders overall, with 11 identified as experts and 20 as familiar with the issue. The R&D and education sector also demonstrates a high level of expertise, contributing 9 experts and 3 familiar stakeholders. Public service organizations and NGOs are less represented, but each sector includes both experts and familiar stakeholders.

Only two stakeholders-one from the private sector and one from NGOs-were classified as uninformed (Graph 3).

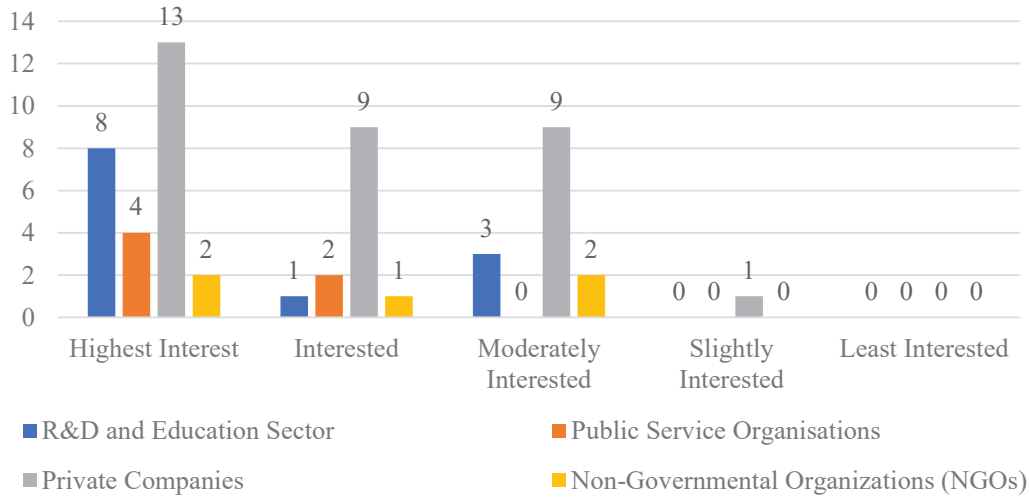
Graph 3: Level of knowledge about the issue by sector



Source: DRWO4.0 Project Website, n.d.

Graph 4 illustrates the distribution of stakeholder interest in the transformation of the forest-based industry, categorized into five levels: Highest Interest, Interested, Moderately Interested, Slightly Interested, and Least Interested. Private companies show the strongest engagement, leading the "Highest Interest" group with 13 stakeholders, followed by the R&D and Education sector with 8 and Public Service Organizations with 4. In the "Interested" category, private companies again dominate with 9 stakeholders, while R&D and Education and Public Service Organizations contribute 2 and 1, respectively. The "Moderately Interested" group consists of 3 stakeholders from the R&D and Education Sector, 2 from NGOs, and 9 from Private Companies, while no Public Service Organizations are represented in this category. Only one stakeholder from Private Companies was categorized as "Slightly Interested," and none were classified as "Least Interested." (Graph 4).

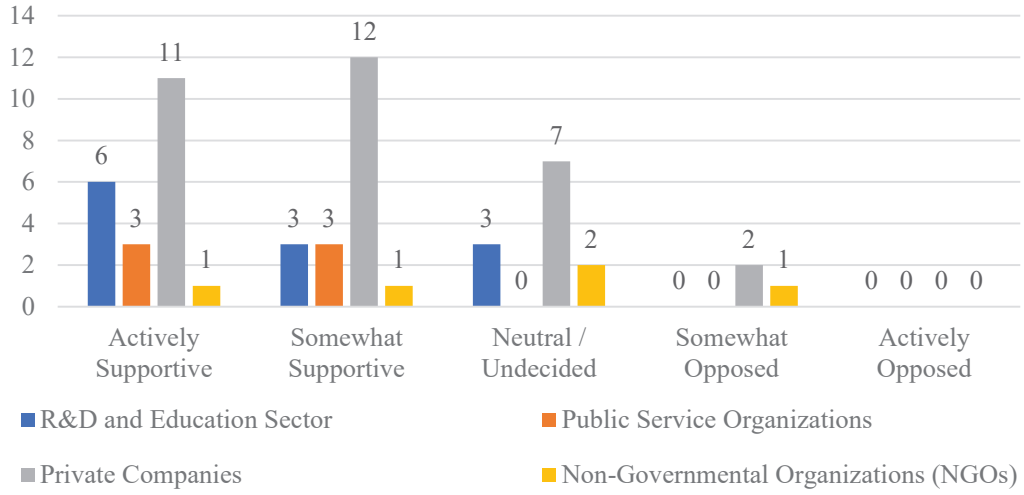
Graph 4: Interest of stakeholders by sector



Source: DRWO4.0 Project Website, n.d.

Graph 5 illustrates the level of stakeholder support for the transformation of the forest-based industry towards I4.0, segmented by organizational type. Private companies showed the strongest active support, with 11 stakeholders in the "Actively Supportive" category and 12 as "Somewhat Supportive." The R&D and Education sector also demonstrated a high level of engagement, with 6 stakeholders actively supportive and 3 somewhat supportive. Public Service Organizations and NGOs were less represented but still contributed to the supportive categories, with 3 public sector stakeholders actively supportive and 3 somewhat supportive, and 1 NGO in each of these groups. The "Neutral/Undecided" and "Somewhat Opposed" categories were mainly composed of private companies and public service organizations, while no sector registered any stakeholders as "Actively Opposed" (Graph 5).

Graph 5: Level of support by sector

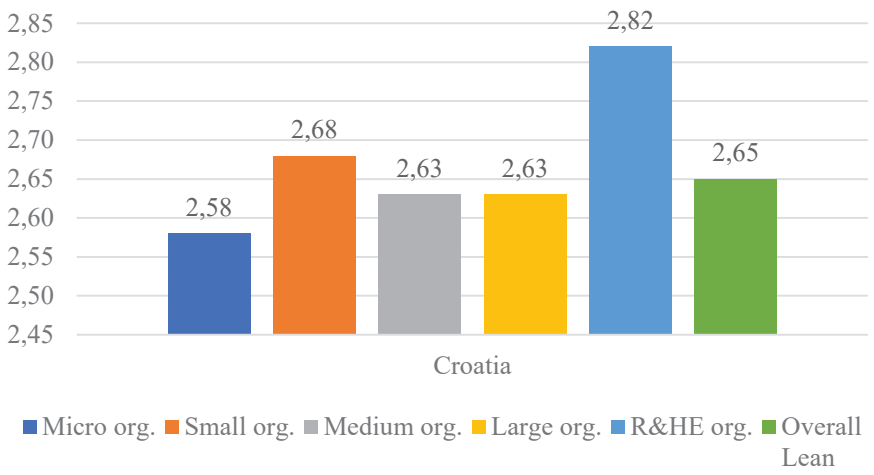


Source: DRWO4.0 Project Website, n.d.

Building on the stakeholder analysis, the next step was to assess surveyed Danube region countries using a questionnaire based on the CULIS methodology, which integrates Lean, Digital, and Green transformation pillars (Biondić et al., 2022, pp. 2–4). The questionnaire was completed by 170 institutions from Croatia (21), Slovenia (25), Serbia (16), Hungary (19), Ukraine (15), Moldova (11), Bosnia and Herzegovina (13), Czech Republic (15), Romania (11), Bulgaria (12), and Austria (12).

The assessment of Lean manufacturing implementation across different organization sizes in Croatia revealed varying levels of adoption. Micro-organizations achieved the lowest score of 2.58, while small organizations obtained a slightly higher score of 2.68. Medium and large organizations recorded identical results with an average score of 2.63, while research and higher education institutions attained the best result, with an average score of 2.82 (Graph 6).

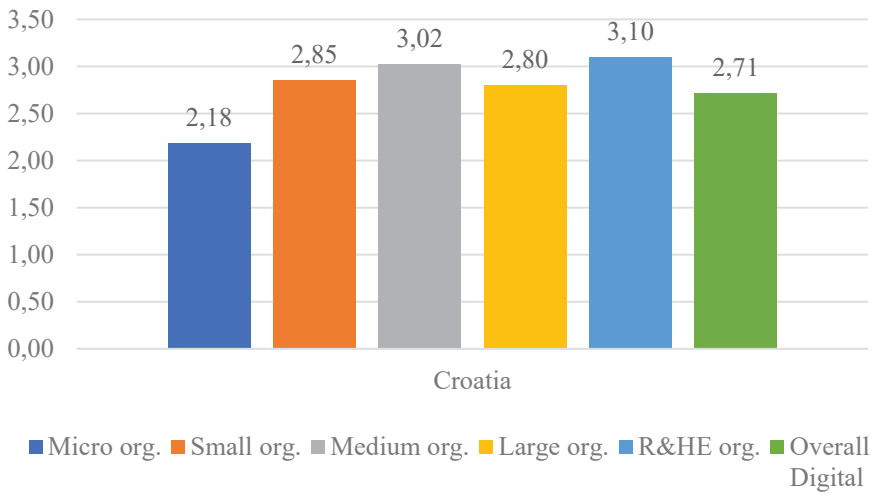
Graph 6: Lean Grades - Croatia



Source: DRWO4.0 Project Website, n.d.

In the case of Digitalization, the results by organization size show that micro-enterprises have the lowest score of 2.18, while small enterprises achieve a slightly better result with 2.85. Medium-sized enterprises achieved the highest score among organizations, 3.02, while large enterprises were rated at 2.80. The highest score, 3.10, was achieved by research and higher education institutions (Graph 7).

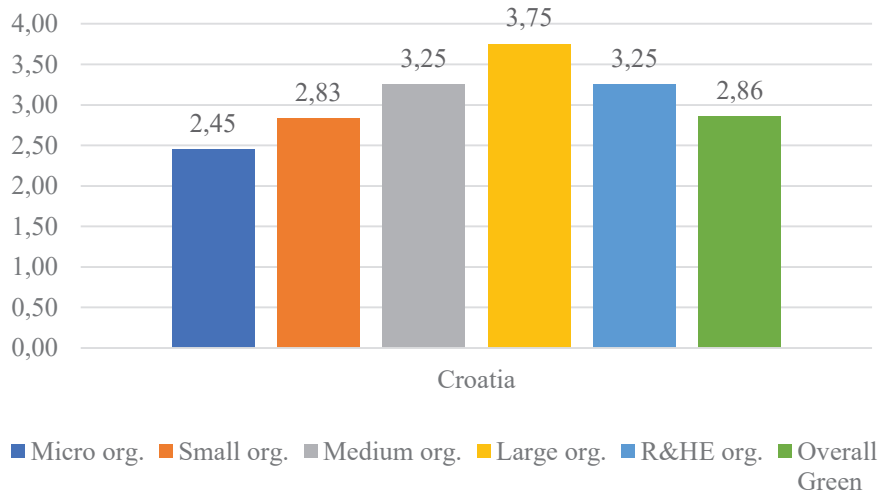
Graph 7: Digital Grades - Croatia



Source: DRWO4.0 Project Website, n.d.

The Green manufacturing assessment showed increasing scores correlating with organization size. Micro-enterprises have a score of 2.45, while small enterprises achieve a slightly better result of 2.83. Medium-sized enterprises, as well as research and higher education institutions, attain an identical score of 3.25, while large enterprises achieve the highest score of 3.75 (Graph 8).

Graph 8: Green Grades - Croatia



Source: DRWO4.0 Project Website, n.d.

The insights gained from this assessment serve as the basis for the next phase of the research—a comparative analysis of the current status of Danube region countries in the context of implementing I4.0 technologies, aiming to understand their achievements and challenges.

Croatia's average Lean transformation score of 2.65 positioned it below most Danube region countries, with Serbia (3.35), Slovenia (3.27), and Bulgaria (3.23), Moldova (3.11), Austria (3.03), Ukraine (3.03), and the Czech Republic (3.01) are ahead. These are followed by Hungary (2.83) and Bosnia and Herzegovina (2.81), while Croatia shares the most similar result with Romania (2.69), but overall lags behind the regional average (Table 3).

Table 3: Lean grades by countries and size of companies

#	Country	Micro org.	Small org.	Medium org.	Large org.	R&HE org.	Overall Lean
1.	Austria	2.17	3.28	3.92	N/A	N/A	3.03
2.	Bosnia and Hercegovina (BIH)	N/A	2.59	3.00	3.18	N/A	2.81
3.	Bulgaria	2.47	3.22	3.67	3.17	N/A	3.23
4.	Croatia	2.58	2.68	2.63	2.63	2.82	2.65
5.	Czech Republic	1.74	2.85	3.56	N/A	N/A	3.01
6.	Hungary	2.47	3.11	3.47	N/A	N/A	2.83
7.	Moldova	2.95	3.11	4.42	N/A	N/A	3.11
8.	Romania	1.16	2.65	4.58	N/A	N/A	2.69
9.	Serbia	3.74	3.09	3.34	3.42	4.00	3.35
10.	Slovenia	3.01	3.07	3.48	4.37	N/A	3.27
11.	Ukraine	2.48	2.99	3.53	4.53	N/A	3.03
Lean average grade for DANUBE region = 3.00							

Source: DRWO4.0 Project Website, n.d.

Croatia achieved an average score of 2.71 in digitalization, which is below the Danube region average of 2.86. Comparing the results with other countries in the region, Austria (3.78) leads significantly, while Bulgaria (3.07), Slovenia (3.02), the Czech Republic (2.95), Moldova

(2.92), and Serbia (2.90) outperform Croatia. Romania (2.64), Ukraine (2.53), Bosnia and Herzegovina (2.51), and Hungary (2.44), show lower results, positioning Croatia in the middle of the ranking but still below the regional average (Table 4).

Table 4: Digital grades by countries and size of companies

#	Country	Micro org.	Small org.	Medium org.	Large org.	R&HE org.	Overall Digital
1.	Austria	3.20	3.96	4.17	N/A	N/A	3.78
2.	Bosnia and Hercegovina (BIH)	N/A	2.03	2.75	3.70	N/A	2.51
3.	Bulgaria	2.63	3.05	3.07	3.53	N/A	3.07
4.	Croatia	2.18	2.85	3.02	2.80	3.10	2.71
5.	Czech Republic	1.33	2.64	3.84	N/A	N/A	2.95
6.	Hungary	2.12	2.72	2.80	N/A	N/A	2.44
7.	Moldova	2.77	2.57	4.80	N/A	N/A	2.92
8.	Romania	1.20	2.59	4.60	N/A	N/A	2.64
9.	Serbia	1.67	2.72	2.34	3.67	3.80	2.90
10.	Slovenia	2.53	2.63	3.52	3.93	N/A	3.02
11.	Ukraine	2.07	2.76	2.44	3.80	N/A	2.53
Digital average grade for DANUBE region = 2.86							

Source: DRWO4.0 Project Website, n.d.

In the area of green transformation, Croatia achieves an average score of 2.86, which is below the Danube region average of 3.04. Comparing Croatia with other countries, Austria (3.46), Moldova (3.46), Romania (3.46), Bulgaria (3.24), Slovenia (3.18), the Czech Republic (2.99), Bosnia and Herzegovina (2.98), Hungary (2.98), and Serbia (2.88) perform better, while Ukraine (2.53) is ranked lower. (Table 5)

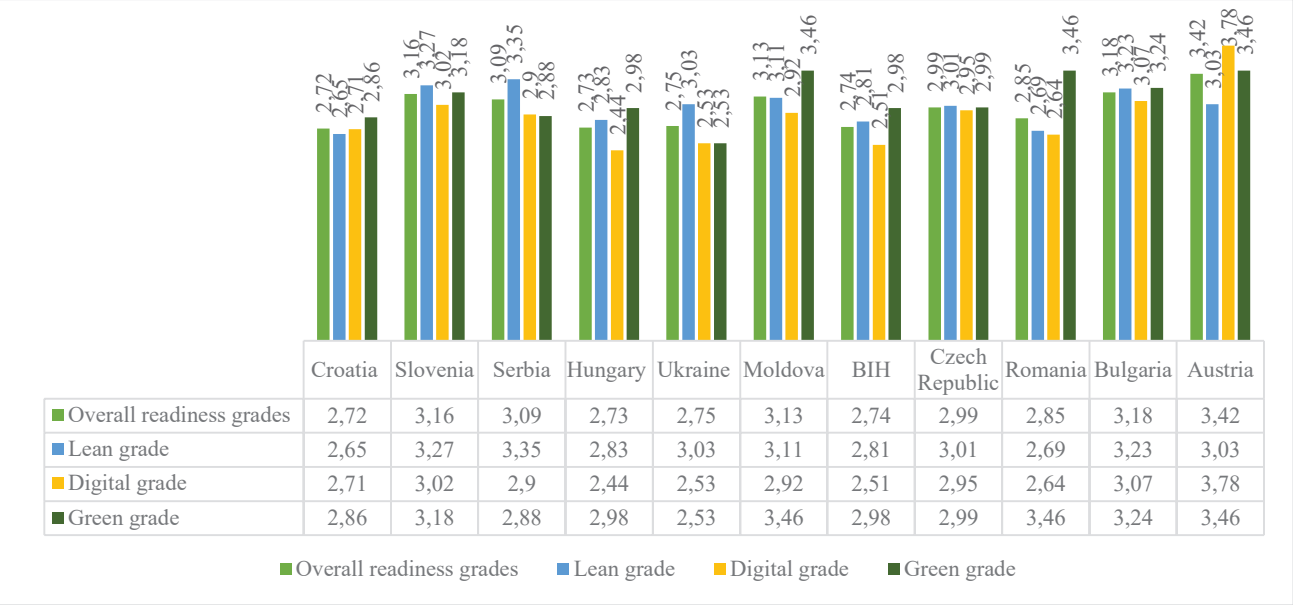
Table 5: Green grades by country and sizes

#	Country	Micro org.	Small org.	Medium org.	Large org.	R&HE org.	Overall Green
1.	Austria	2.60	3.33	4.45	N/A	N/A	3.46
2.	Bosnia and Hercegovina (BIH)	N/A	2.53	3.38	3.75	N/A	2.98
3.	Bulgaria	3.00	2.83	3.63	3.55	N/A	3.24
4.	Croatia	2.45	2.83	3.25	3.75	3.25	2.86
5.	Czech Republic	2.10	2.61	3.86	N/A	N/A	2.99
6.	Hungary	2.72	3.30	2.40	N/A	N/A	2.98
7.	Moldova	3.40	3.15	4.60	N/A	N/A	3.46
8.	Romania	1.70	3.53	4.60	N/A	N/A	3.46
9.	Serbia	2.00	2.60	3.08	2.90	3.10	2.88
10.	Slovenia	3.18	2.74	3.59	2.60	N/A	3.18
11.	Ukraine	1.98	2.45	3.00	4.40	N/A	2.53
Green average grade for DANUBE region = 3.04							

Source: DRWO4.0 Project Website, n.d.

A detailed display of all results is presented in Graph 9.

Graph 9: Summary of the grades by the countries in Danube region



Source: DRWO4.0 Project Website, n.d.

The results of the analysis clearly indicate significant engagement of key Croatian stakeholders in aligning with the principles and requirements of I4.0. Although stakeholders from various sectors have demonstrated different levels of interest, knowledge, and readiness for the implementation of new forest-based industrial standards, there is a clear tendency towards a positive approach to transformation towards I4.0.

5. Discussion

Industry 4.0, first conceptualized at the German Hannover Fair in 2011, represents a transformative shift in industrial paradigms, empowering sectors through digitization and automation. It impacts product design, manufacturing processes, delivery systems, and payment mechanisms. Despite growing academic attention, I4.0 remains in its early implementation stages, presenting opportunities and challenges for businesses planning its adoption (Solikhah et al., 2024, p. 1). Addressing these challenges requires a multisectoral approach involving academia, industry, government, and civil society to create collaborative frameworks essential for navigating digital transformation complexities (Khan et al., 2022, p. 4). This paper set out to (1) identify the key stakeholders involved in the I4.0 transformation, (2) assess their levels of readiness and support, and (3) evaluate Croatia's position in Lean, Green, and Digital maturity compared to other countries in the Danube Region.

5.1. Stakeholder Landscape and Dynamics

Stakeholder mapping across 11 Danube Region countries revealed a diverse ecosystem, with Croatia having the highest number of mapped actors (55). These included private companies (32), R&D and education institutions (12), public service organizations (6), and NGOs (5). The mapping process also uncovered distinct patterns of influence and support among stakeholders, essential for successfully driving I4.0 implementation.

The dominance of private sector entities among Key Players suggests market-driven transformation requiring targeted strategies to address private sector priorities (Blok et al., 2015, pp. 149, 159). Limited NGO representation highlights challenges related to legitimacy and funding dependence; however, strategic partnerships with influential stakeholders could amplify their impact (Banks et al., 2015, pp. 149–159; Biekart & Fowler, 2022, pp. 10–12)

The R&D and Education sector demonstrates a high level of reported expertise, with 9 out of 12 respondents (75%) categorized as experts regarding the issue of low application of forest-based industry standards. In the case of Public Service Organizations, 4 out of 6 participants (67%) are classified as experts. The private sector also shows a significant proportion of experts, with 11 out of 31 respondents (35%) falling into this category. These results highlight the need for targeted knowledge-sharing initiatives, particularly to further enhance expertise within the private sector.

Universities and technology centres play a pivotal role in facilitating knowledge transfer through best practices and training programs (Hofer, 2007, p. 1). Collaborative projects like DRWO4.0 demonstrate effective integration of academic research with industrial needs to enhance digital readiness across the Danube region (*DRWO4.0 Project Website*, n.d.).

Stakeholder interest is high among R&D institutions and NGOs but fragmented within the private sector. Active participation significantly contributes to innovation and process efficiency (Mrosek et al., 2010, p. 7). Support for I4.0 transformation varies across sectors: R&D and education show strong backing with 9 out of 12 respondents (75% supportive), while the private sector demonstrates mixed commitment due to high costs and regulatory barriers. The absence of active opposition creates a supportive environment for strengthening support through focused engagement efforts (Sayem et al., 2022, pp. 12, 17, 20).

These insights underscore the importance of public-private-academic collaboration. While the private sector is positioned to drive transformation, its uneven knowledge levels necessitate stronger partnerships with academia and public bodies to ensure inclusive progress.

5.2. Lean, Green, and Digital

Croatia demonstrates below-average performance in Lean, Digital, and Green transformation compared to other countries in the Danube Region.

In lean transformation, Croatian organizations achieve an average score of 2.65, below the Danube region average of 3.00, while in digital manufacturing, the average score is 2.71 compared to the regional average of 2.86. Green transformation records a score of 2.86, also below the regional average of 3.04. The research highlights that micro and small enterprises in Croatia lag significantly, while larger organizations and research institutions perform better, providing a solid foundation for further development. These results underscore the need for targeted investments, particularly in sectors least adapted to change, to improve overall I4.0 readiness and ensure long-term sustainability (Maravić et al., 2022b, p. 12).

A comparative analysis places Croatia in a broader regional context, emphasizing its lag in key areas compared to most countries in the Danube region. In lean transformation, Croatia falls behind leaders such as Serbia (3.35) and Slovenia (3.27). In digital manufacturing, Austria (3.78) and Bulgaria (3.07) are far ahead, while Croatia ranks lower. In green transformation, although larger organizations in Croatia achieve solid results, the country remains below the

regional average, falling behind Austria, Moldova, and Romania (all scoring 3.46). On the other hand, Croatia surpasses Ukraine (2.53) in this area (Graph 9). Mladineo et al. similarly found that Croatian manufacturing enterprises achieved 50% progress regarding sustainability, with variation between enterprises. Their research indicates that organizations with good product lifecycle management and environmental management standards like ISO 14001 achieved higher sustainability scores (Mladineo et al., 2024, p. 10).

These results highlight the need for strategic investments in micro and small enterprises, while larger organizations and research institutions offer collaboration opportunities aimed at achieving regional competitiveness. Comparative data underscore the urgency of reforms to close the gap with leading countries in the region. Maravić et al. emphasized Croatia's lack of supportive national policies to stimulate technology implementation, recommending investments in digital infrastructure, public administration services, STEM education, digital skills, and regulatory modernization (Maravić et al., 2022b, p. 13)

5.3. Implications and Recommendations

The analysis provides clear responses to the research questions:

1. *Who are the key stakeholders in the wood industry's I4.0 transformation in the Danube Region, and what roles do they play?*

Predominantly private companies, followed by R&D and public institutions. Private firms act as primary drivers of technological adoption, while R&D institutions provide expertise and innovation capacity. Public organizations offer regulatory and policy support. NGOs have a limited but present role, often related to sustainability and advocacy.

2. *To what extent are wood sector organizations prepared for I4.0 adoption across Lean, Digital, and Green dimensions?*

Croatia underperforms the regional average across all three dimensions, particularly in Lean and Digital transformation. Micro and small enterprises show the lowest readiness, while academic and research institutions perform relatively well. This unevenness highlights a need for targeted capacity-building and support mechanisms.

3. *What are the main regional differences in I4.0 readiness within the Danube Region, focusing on Croatia?*

Croatia lags behind leading countries such as Austria, Slovenia, Serbia and Bulgaria, especially in Lean and Digital capabilities. Austria ranks highest in Digital and Green transformation, while Serbia and Bulgaria show strong Lean adoption. These differences reflect varying levels of policy support, infrastructure investment, and enterprise innovation culture across the region. Croatia's underutilized academic excellence and supportive stakeholder environment offer a strategic opportunity for catching up.

4. *What policy and strategic measures can accelerate the digital transformation of the wood sector?*

To bridge existing gaps and support I4.0 integration in the forest-based industry, a multi-level strategy is advised:

- Strengthen collaboration between private, academic, and public sectors to facilitate knowledge transfer.
- Develop targeted support programs for micro and small enterprises to boost Lean and Digital maturity.
- Improve access to technological infrastructure and financial incentives, particularly for SMEs.
- Position academic and R&D institutions as regional knowledge hubs to scale expertise.
- Encourage multi-stakeholder innovation ecosystems to promote collective engagement and diffusion of I4.0 practices.

By operationalizing these strategies, Croatia can better align its forest-based industry with regional transformation dynamics, enhancing both sustainability and long-term competitiveness. These findings offer a valuable framework for policymakers and industry leaders aiming to synchronize the wood sector with broader European innovation trends.

6. Limitations

This study acknowledges several limitations that contextualize its findings and guide future research. Conducted over a short period (June to September 2024), it may not fully capture dynamic changes in stakeholder attitudes or readiness levels. A longitudinal approach would provide a more comprehensive understanding of how readiness evolves over time and how external factors such as economic shifts or policy changes impact stakeholder engagement.

Methodologically, the study relied heavily on structured questionnaires and stakeholder mapping, which may not fully capture complex perspectives of all stakeholders. The CULIS methodology offers a systematic framework but may overlook specific sectoral traits, particularly for micro-enterprises and smaller organizations.

The comparative analysis highlights regional differences in technological infrastructure, economic resources, and workforce skills, limiting the universality of findings. Croatia's position below the regional average in Lean, Digital, and Green transformations reflects systemic issues that may not apply uniformly across other countries in the region.

In Croatia, out of 55 mapped stakeholders, 21 completed the questionnaire. While this represents a valuable sample for analysis, some stakeholder groups remain underrepresented, which may limit the comprehensiveness of the findings and highlights the need for broader engagement in future research. NGOs formed a smaller proportion of influential stakeholders. This underrepresentation may limit the study's ability to explore the role of NGOs in driving I4.0 adoption. Similarly, private companies dominated key categories, but their variability in knowledge levels suggests that further classification could produce more targeted insights.

The wood industry's unique characteristics, including resource dependency, environmental concerns, and traditional operational practices, present distinct challenges that require tailored transformation strategies (May et al., 2017, pp. 2, 3). These strategies must integrate sector-

specific considerations into broader I4.0 adoption frameworks to effectively address these challenges.

By acknowledging these limitations, this study provides a foundation for more targeted future research that addresses methodological gaps, explores longitudinal trends, and develops sector-specific strategies for I4.0 adoption in the forest-based industries.

7. Conclusion

This study examined the readiness of the Danube region's wood industry for I4.0, focusing on Croatia. It revealed a stakeholder landscape led by the private sector and supported by R&D and education institutions, while NGOs remain underutilized. Croatia lags behind regional averages in Lean, Digital, and Green transformation, especially among micro and small enterprises.

With strong academic capacity and a supportive stakeholder environment, Croatia has a unique opportunity to accelerate digital transformation. Bridging the gap between research and industry, supporting SMEs, and reinforcing policy frameworks are essential.

A coordinated, multi-stakeholder approach—anchored by institutions like the Competence Centre—can foster innovation, competitiveness, and sustainability in Croatia's forest-based industry to meet I4.0 demands.

Further research should explore longitudinal data to track I4.0 adoption in the wood sector. Comparative studies across regions or industries could identify success factors. Qualitative insights from SME managers and policymakers would deepen understanding of barriers and incentives. Future work could also examine the role of AI and IoT's role in transforming supply chains, sustainability, and workforce skills.

REFERENCES

Banks, N., Hulme, D., & Edwards, M. (2015): ***NGOs, States, and Donors Revisited: Still Too Close for Comfort?*** *World Development*, *66*, 707–718. https://doi.org/10.1016/j.worlddev.2014.09.028

Biekart, Kees., & Fowler, Alan. (2022): ***A research agenda for civil society.*** Edward Elgar Publishing.

Biondić, I., Štefanić, A., Klasić, T., Brnadić, T., & Štefanić, N. (2022): ***The New Maintenance Model in Conditions of Industry 4.0.*** *Lean Spring Summit*.

Blok, V., Hoffmans, L., & Wubben, E. F. M. (2015): ***Stakeholder engagement for responsible innovation in the private sector: Critical issues and management practices***. *Journal on Chain and Network Science*, *15*(2), 147–164. https://doi.org/10.3920/JCNS2015.x003

Borovics, A., & Király, É. (2023): ***The Challenge of Mobilizing the Unused Wood Stock Reserve to Foster a Sustainable and Prosperous Hungarian Forest Industry.*** *Chemical Engineering Transactions*, *107*, 637–642. https://doi.org/10.3303/CET23107107

Brugha, R., & Varvasovszky, Z. (2000): ***Stakeholder analysis: a review.*** *Oxford University Press*.

DRWO4.0 project website. (n.d.): Retrieved January 29, 2025, from https://interreg-danube.eu/projects/drwo40

Endrodi-Kovács, V., & Stukovszky, T. (2022): ***The adoption of industry 4.0 and digitalisation of Hungarian SMEs.*** *Society and Economy*, *44*(1), 138–158. https://doi.org/10.1556/204.2021.00024

European Commission. (2021): ***The new EU Strategy on Adaptation to Climate Change.*** https://ec.europa.eu/jrc/en/peseta-iv/economic-impacts

European Commission. (2024): ***Digital Decade Country Report 2024: Croatia.*** https://digital-strategy.ec.europa.eu/en/news-redirect/833351

Gallina, V., Nick, G., Szaller, Á., Várgedő, T., & Schumacher, A. (2019): ***Industry 4.0 in Germany, Austria and Hungary: interpretation, strategies and readiness models***. https://www.researchgate.net/publication/335834025

Grzegorzewska, E., & Sedliačiková, M. (2021): ***Labour Productivity in the Sustainable Development of Wood-based Industry: A Case for the European Union Countries***. In *BioResources* (Vol. 16, Issue 2).

Hecklau, F., Galeitzke, M., Flachs, S., & Kohl, H. (2016): ***Holistic Approach for Human Resource Management in Industry 4.0***. *Procedia CIRP*, *54*, 1–6. https://doi.org/10.1016/J.PROCIR.2016.05.102

Hegedić, M., Gudlin, M., & Štefanić, N. (2018): ***Relationship Between Lean and Green Management in Croatian Manufacturing Companies***. *Interdisciplinary Description of Complex Systems*, *16*(1), 21–39. https://doi.org/10.7906/indecs.16.1.2

Hofer, F. (2007): ***Knowledge Transfer Between Academia and Industry***. https://doi.org/10.4018/9781599049335.ch252

Hölzl, W., Bärenthaler-Sieber, S., Bock-Schappelwein, J., Friesenbichler, K. S., Kügler, A., Reinstaller, A., Hofmann, K., Schmidt, N., Strauss-Kollin, A., & Weingärtner, S. (2019): ***Digitalisation in Austria State of Play and Reform Needs***. https://www.wifo.ac.at/

Khan, I. S., Kauppila, O., Fatima, N., & Majava, J. (2022): ***Stakeholder interdependencies in a collaborative innovation project.*** *Journal of Innovation and Entrepreneurship*, *11*(1). https://doi.org/10.1186/s13731-022-00229-0

Kropivšek, J., & Grošelj, P. (2020): ***Digital development of Slovenian wood industry.*** *Drvna Industrija*, *71*(2), 139–148. https://doi.org/10.5552/drvind.2020.1961

Kropivšek, J., Perić, I., Barčić, A. P., Grošelj, P., Motik, D., & Jošt, M. (2019): ***A comparative evaluation of operational efficiency of wood industry using data envelopment analysis and malmquist productivity index: The cases of Slovenia and Croatia***. *Drvna Industrija*, *70*(3), 287–298. https://doi.org/10.5552/drvind.2019.1937

Li, L. (2022): ***Reskilling and Upskilling the Future-ready Workforce for Industry 4.0 and Beyond***. *Information Systems Frontiers*. https://doi.org/10.1007/s10796-022-10308-y

Lianu, C., & Gudei, C. (2017): ***Economic diplomacy, community in macro-regional perspective - the case of Danube region***. https://doi.org/10.26458/v4.i1.28

Maravić, D., Redek, T., & Čater, T. (2022a): ***Implementation of Industry 4.0 Technologies in Croatia: Proactive Motives and a Long-Term Perspective***. *Društvena Istraživanja*, *31*(1), 39–61. https://doi.org/10.5559/di.31.1.03

Maravić, D., Redek, T., & Čater, T. (2022b): ***IMPLEMENTATION OF INDUSTRY 4.0 TECHNOLOGIES IN CROATIA: PROACTIVE MOTIVES AND A LONG-TERM PERSPECTIVE***. *Drustvena Istrazivanja*, *31*(1), 39–61. https://doi.org/10.5559/di.31.1.03

May, N., Guenther, E., & Haller, P. (2017): ***Environmental indicators for the evaluation of wood products in consideration of site-dependent aspects: A review and integrated approach***. In *Sustainability (Switzerland)* (Vol. 9, Issue 10). MDPI. https://doi.org/10.3390/su9101897
Mereuta, C., Jansova, E., & Vuorinen, P. (2021). *Assessing skills implications of smart specialisation priorities*.

Mladineo, M., Celent, L., Milković, V., & Veža, I. (2024): ***Current State Analysis of Croatian Manufacturing Industry with Regard to Industry 4.0/5.0.*** *Machines*, *12*(2). https://doi.org/10.3390/machines12020087

Mrosek, T., Amann, M., Kies, U., Allen, S. D., & Schulte, A. (2010): ***A Framework for Stakeholder Analysis of Forest and Wood-Based Industry Clusters-Case Study at the State of North Rhine-Westphalia, Germany***. In *The Open Forest Science Journal* (Vol. 3).

Sahal, R., Alsamhi, S. H., Breslin, J. G., & Ali, M. I. (2021): ***Industry 4.0 towards forestry 4.0: Fire detection use case.*** *Sensors (Switzerland)*, *21*(3), 1–36. https://doi.org/10.3390/s21030694

Sayem, A., Biswas, P. K., Khan, M. M. A., Romoli, L., & Dalle Mura, M. (2022): ***Critical Barriers to Industry 4.0 Adoption in Manufacturing Organizations and Their Mitigation Strategies***. *Journal of Manufacturing and Materials Processing*, *6*(6). https://doi.org/10.3390/jmmp6060136

Solikhah, E. W., Asih, H. M., Astuti, F. H., Ghazali, I., & Mohammad, E. Bin. (2024): ***Industry 4.0 Readiness Trends: A Bibliometric and Visualization Analysis***. *International Journal of Robotics and Control Systems*, *4*(1), 105–124. https://doi.org/10.31763/ijrcs.v4i1.1247

The World Bank. (2023): ***Croatia Digital Diagnostic: Policy Brief***.

United Nations Industrial Development Organization. (2020). *THE INNOVATION ECOSYSTEM OF MOLDOVA*.

Zavarská, Z. (2024): ***Economic strategies for a thriving Danube Region Standard-Nutzungsbedingungen.*** https://hdl.handle.net/10419/307688

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ENTREPRENURSHIP

A scientific paper

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CULTURAL BACKGROUND AS A PREDICTOR OF ENTREPRENEURIAL INTENTION

ABSTRACT

Entrepreneurial intentions are a very important factor in predicting the future behavior of youths, especially with regard to their willingness to start a new business. One of the most interesting bases for such an investigation is Ajzen's theory of planned behavior (TPB). Although much research has been conducted based on the TPB, there is still a need for research on other factors that may influence the entrepreneurial intention of youths. One of these factors is cultural and religious background and environment. In this study, we want to investigate these aspects in more detail. Culture and religion are an important aspect of social life that can significantly influence various behaviors, including the entrepreneurial intentions of young people. This paper examines the influence of religious beliefs, values and rituals on young people's entrepreneurial intentions. The research was conducted online in 2024 and 2025. The final research results represent a sample of more than 150 respondents from different countries, including Croatia, Bosnia and Herzegovina and Serbia, especially those whose behavior and entrepreneurial intentions are potentially influenced by three different religions. Four hypotheses were tested to further investigate the relationship between religion and entrepreneurship. The data analysis included a Principal Components Analysis (PCA) with Varimax rotation, which was performed to assess the factor structure. In addition, Spearman correlation analysis, regression analysis and the Kruskal-Wallis test were used, while homoscedasticity and autocorrelation were examined using correlation analysis and the Durbin-Watson test. The research findings suggest that religious beliefs can have a positive influence on entrepreneurial intentions, with respondents who practiced religious rituals and attached importance to religious values showing a greater willingness to engage in entrepreneurial activity. The study also found differences in the entrepreneurial intentions of respondents from different cultural and religious backgrounds. The main limitation of the study is the relatively limited number of respondents from the three Balkan countries.

Key words: *Entrepreneurial Intentions, Cultural Differences, Students, Theory of Planned Behavior.*

1. Introduction

Research on entrepreneurial intentions, i.e. the desires or intentions of individuals to start their own business, is becoming increasingly important to understand the future entrepreneurial potential of individuals (Zovko et al, 2020; Esfandiar et al, 2019; Adamu and Mansur, 2018; Fayolle & Liñán, 2014; Bilić at al, 2011). Most of this research was based on Ajzen's (1991) theory of planned behaviour, which is based on psychological factors such as attitudes, social norms and perceived sense of control, as well as other factors that trigger entrepreneurial events (Shapero and Sokol, 1982), or on models of entrepreneurial intentions (Krueger et al., 2000). In addition, entrepreneurship research has focused on understanding entrepreneurs and finding ways to identify potential entrepreneurs (Carsrud & Brännback, 2014).

Moreover, most previous research has focused on entrepreneurial intention while neglecting religious and cultural aspects. Some religions promote desirable characteristics of entrepreneurs such as work ethic, thrift, and initiative. The Protestant ethic (Weber in Kalberg 2012) is characterised by work ethic, responsibility and rationality, while some religions emphasise the importance of modesty, satisfaction with the status quo and togetherness (Anwar and Abdullah, 2021). Religion and religiosity are believed to influence or motivate followers in their entrepreneurial behaviour (Adamu and Mansur, 2018) and can be a strong driver for engagement in social entrepreneurship (Bacq et al., 2020), with the aim of helping others. Some previous research provides interesting directions for future research, such as religiosity as a cultural dimension for entrepreneurship development (Woodside et al., 2020) or the influence of religiosity and spirituality on the entrepreneurial process (Toledano, 2020). In the latest Global Entrepreneurship Monitor survey, Croatia ranks last in terms of social and cultural norms with a score of 2.7 out of 10 compared to 19 countries in its group (GEM, 2024/2025).

Thus, the main novelty in the research on entrepreneurial intentions is to examine the influence of religion on entrepreneurial intentions in the three Balkan countries, assuming that there are many other cultural similarities between these three countries. On the other hand, the three Balkan countries represent different religions, with the three dominant religions being Christianity, Orthodoxy and Islam. The paper is organized as follows. The introduction is followed by a brief overview of the existing literature on entrepreneurial intentions and previous research, in particular on entrepreneurial intentions in the countries under consideration. A literature review of previous research on culture, religion and entrepreneurship is also provided. The results of a recent study on cultural background as a predictor of entrepreneurial behavior are then presented. Finally, the main findings are summarized, their implications discussed and recommendations for future research and practice are given.

2. Literature review

The theory of planned behaviour is defined as the ability to perform a certain behaviour (Ajzen, 2002), and it is mostly used to predict an individual's entrepreneurial behaviour. Krueger et al. (2000) considered entrepreneurial intentions as a means to better explain and predict entrepreneurial behaviour. In addition, Shapero and Sokol (1982) found that an entrepreneurial event is shaped by social variables and the social and cultural environment.

Bilić et al. (2011) investigated the entrepreneurial orientation of students at the University of Split, Croatia, and found that students lack entrepreneurial orientation. Singer et al. (2017) concluded in the GEM survey that Croatia lags behind in recognising opportunities and intentions related to entrepreneurial activities. Morić Milovanović et al. (2015) concluded that creating entrepreneurial self-efficacy is an essential characteristic for creating entrepreneurial intentions, while Zovko et al. (2020) found that attitudes towards entrepreneurship have a significant and positive influence on entrepreneurial intentions.

Turulja et al. (2020) pointed out the need for further research in the field of entrepreneurial intentions in Bosnia and Herzegovina and proposed a model that analyses the impact of formal, informal, legal and educational support on students' entrepreneurial intentions. Šestić et al. (2017) confirmed the intention of students to find a state job, while entrepreneurship is not seen as the most attractive option. Petković (2017) also states that personal competence and motivation of students are predictors of entrepreneurial intentions of students in the Republic of Serbia, one of the entities in Bosnia and Herzegovina.

Recent Serbian research on entrepreneurial intention has shown that entrepreneurial intention can be predicted by a positive attitude towards entrepreneurship, while individual entrepreneurial orientation is not related to entrepreneurial intention. However, subjective norms show a low but significant negative relationship with entrepreneurial intention (Popov et al., 2023). In addition, Djordjevic et al. (2021) find that students' attitudes influence the intention to start their own business in Serbia, although there is a contradiction: The more positive the attitude, the less likely students are to have entrepreneurial intentions. Nikolić Tošović and Jovanović (2021) found that personal attitude and strong behavioural control have a statistically significant direct positive influence on the entrepreneurial intentions of Serbian students.

In their Indonesian study, Nino et al. (2022) found that religiosity has a positive influence on interest in entrepreneurial activity, which is mediated by belief in a higher power and fear of entrepreneurial activity. Cornelius et al. (2022) examined Schwartz's theory of basic human values and entrepreneurship and found that the contrasting value priorities of religious believers and entrepreneurs attenuate this relationship, with results for the major religions in Europe being quite similar depending on how actively engaged people are in a religion. Toledano (2019) found that the religiosity/spirituality of entrepreneurs influences their entrepreneurial lifestyle.

Musallam and Kamarudin (2021) conducted a literature review of papers published in the WoS that address previous research on the complex relationship between entrepreneurship and religion. The main conclusions point to a complicated relationship between religion and entrepreneurship and the fact that most of the research has been conducted in relation to a single religion and entrepreneurship.

Previous research on the relationship between religiosity and entrepreneurial intentions has shown that there is a significant relationship between religiosity and the intention to engage in social entrepreneurship, but not in traditional business (McIntyre et al., 2023). Furthermore, Giacomin et al. (2022) find that religious affiliation - agnostic/atheist – is positively related to entrepreneurial intentions, while religiosity influences entrepreneurial intentions differently depending on religion, suggesting that religiosity is a greater influencing factor than religion itself.

The three countries studied, Bosnia and Herzegovina, Croatia and Serbia, are now referred to as "legal cultures in transition". These legal cultures are characterized by the introduction of pluralistic democracy, the rule of law, legal formalism and legal transplants from Western countries. In addition, the commonalities can be seen in a shared history and language, in terms of intellectual elements, especially in legal reasoning and the operationalization of law (Bubalo, 2023). These three countries are also in different situations when it comes to joining the European Union. Croatia has been a member of the EU since 2013, Serbia is a candidate country and Bosnia and Herzegovina is not even a candidate country yet. Accordingly, the cultural and legal freedom work in all the countries observed is influenced by these processes and the current status of the country.

The relationship between religion and entrepreneurship has also been the focus of researchers' interest, but has not been studied in Bosnia and Herzegovina, Croatia and Serbia, especially not in relation to entrepreneurial intentions. Summarizing the most recent studies in the surveyed countries of Bosnia and Herzegovina, Croatia and Serbia, it is clear that while there are surveys on entrepreneurial intentions, there is a lack of surveys dealing with cultural and religious aspects to investigate their influence on entrepreneurial intentions. Nevertheless, four main hypotheses were developed for this study based on previous research. Hypothesis 1: Religious beliefs have a positive influence on entrepreneurial intentions; Hypothesis 2: Certain religious values (e.g. religious rituals) have a significant influence on entrepreneurial intentions; Hypothesis 3: There is a significant difference in the level of entrepreneurial intentions between members of different religious communities; Hypothesis 4: There is a significant difference in the level of entrepreneurial intentions between respondents with different cultural backgrounds.

3. Data and Methods

3.1. Questionnaire design

The questionnaire was designed and administered online to facilitate access to a broader population, as the study includes respondents from three different countries: Bosnia and Herzegovina, Croatia and Serbia. The online format ensured efficient data collection across geographical boundaries and allowed for greater flexibility in participation. The questionnaire was divided into three sections, each covering different aspects relevant to the objectives of the study.

The first section collected demographic and general information about the respondents. It comprised seven questions on gender, age, educational level, educational profile, student status, employment status and entrepreneurial experience. These questions aimed to obtain a comprehensive overview of the participants' background and socio-demographic profiles, which are crucial for understanding the context of their responses.

The second section focused on religious beliefs and values, adapted from the study by Koenig and Büssing (2010) - The Duke University Religion Index (DUREL) which is a validated five-item measure of religious involvement, designed for large observational studies. This section included five questions, where the first three assessed religious beliefs (e.g., experiencing the presence of the Divine, the role of religious beliefs in life, and integrating religion into daily dealings), and the last two measured religious practices: Organizational

Religious Activity (ORA) and Non-Organizational Religious Activity (NORA) (Koenig and Büssing, 2010).

The third section measured entrepreneurial intention using items adapted from the Entrepreneurial Intention Questionnaire (EIQ) by Liñán and Chen (2009). These questions focused on capturing various aspects of the respondents' intentions to engage in entrepreneurial activities. By concentrating on entrepreneurial intention, this section aimed to provide a clear and focused assessment of participants' entrepreneurial mindset. Including this section alongside measures of religious beliefs and practices allowed the study to investigate the potential relationship between religiosity and entrepreneurial intention across a diverse population.

3.2. Data collection and sample

The data for this study was collected using a questionnaire developed on an online platform. The questionnaire was distributed via email and various social media channels to reach a wide audience. Data collection took place from May 2024 to February 2025, so that participants had sufficient time to respond.

A total of 158 responses were collected during this period. However, during the review it was found that 2 questionnaires were filled out incorrectly, so they were excluded from further analysis. The final sample consisted of 156 respondents, whose characteristics and demographic data are described in detail below. The sample comprises 156 participants (Table 1), whereby the gender distribution is almost balanced. Specifically, 80 respondents are male, which corresponds to 51.3 % of the sample, while 76 respndents are female, which corresponds to 48.7 %. The distribution of educational attainment shows that most participants have a high school or bachelor's degree, which together make up 75% of the sample. The majority of the sample (67.9%) are students, suggesting that the sample is predominantly composed of individuals currently in education. Just over half of the participants (52.6%) have an educational background in business-related fields such as economics, management, marketing and finance. The remaining 47.4% are spread across various other disciplines, suggesting a relatively balanced distribution between business and non-business educational profiles. The data shows that about one third (34.6%) of the participants have entrepreneurial experience, while the majority (65.4%) have none. The distribution of employment shows that employment is a significant aspect of the participants' profile: 64.1% of the sample are employed (either full-time or part-time) and 35.9% are not employed.

Looking at the distribution of respondents by nationality, Croatian nationals make up the largest proportion of the sample (45.5 %), followed by Serbian (41 %) and Bosnian and Herzegovinian nationals (13.5 %). This indicates a predominantly Croatian and Serbian sample, with a smaller proportion of participants from Bosnia and Herzegovina. In terms of religious affiliation, the sample is relatively evenly distributed across the three main groups. Catholics make up the largest proportion (39.7%), while Muslims account for 30.8% and the Orthodox 29.5%. This religious diversity within the sample can provide valuable insights into potential cultural and social differences that are relevant to the research.

The composite variable for religious beliefs, based on the mean of three DUREL items, ranges from 1 to 5, with a mean of 3.61 (SD = 1.06). This means that, on average, participants express a moderately high level of agreement with the statements about the role and presence

of religious beliefs in their daily lives. The relatively high mean value indicates that religion is an important guiding figure for many respondents. The standard deviation of 1.06 indicates moderate variability, suggesting a certain diversity in participants' relationship to religious values and their integration into their worldview and behavior.

Table 1: General sample data

		Frequency	Percent
Gender	Man	80	51,3
	Woman	76	48,7
	Total	156	100
Level of education	High school	69	44,2
	Bachelor's degree	48	30,8
	Master's degree	28	17,9
	PhD	11	7,1
	Total	156	100
Student status	Yes	106	67,9
	No	50	32,1
	Total	156	100
Educational profile	Economics, Business, Management, Marketing, Finance etc.	82	52,6
	Other	74	47,4
	Total	156	100
Entrepreneurial experience	Yes	54	34,6
	No	102	65,4
	Total	156	100
Employment	1 Yes - full time	62	39,7
	2 Yes - part time	38	24,4
	3 No	56	35,9
	Total	156	100
Citizenship	1 Croatian	71	45,5
	2 Serbian	64	41
	3 Bosnian and Herzegovinian	21	13,5
	Total	156	100
Religion	1 Catholic	62	39,7
	2 Ortodox	46	29,5
	3 Islam	48	30,8
	Total	156	100

Religious beliefs (DUREL_IR_composite)	Minimum	Maximum	Mean	Std. Deviation
	1	5	3,6111	1,05737

Source: Authors

The age distribution shows that most participants are likely clustered around the mid-20s, with a reasonably wide age range spanning from 18 to 66 years. The standard deviation

indicates some variation in age, but the mean suggests the study primarily involves young adults (Table 2).

Table 2: Age of the participants in the sample

	N	Minimum	Maximum	Mean	Std. Deviation
Age	156	18	66	25,98	8,284

Source: Authors

3.3. Data analysis

The data analysis for this study was conducted using SPSS Version 23 for Mac OS.

Given that the key variables – religious beliefs and entrepreneurial intention were composite in nature, a factor analysis was performed to validate the measurement scales. Specifically, Principal Components Analysis (PCA) with Varimax rotation was employed to assess the factor structure. These composite variables were created by averaging responses to three questions related to religious beliefs and six questions concerning entrepreneurial intention. Additionally, the reliability of the scales was assessed using Cronbach's alpha, which measures internal consistency.

For hypothesis testing, various statistical methods were employed. Spearman correlation analysis was used to examine the relationships between religious beliefs, organizational religious activity, non-organizational religious activity and entrepreneurial intention. This analysis assessed the strength and direction of these relationships, providing preliminary insights into potential associations. To further explore these relationships, regression analysis was applied as well as the Kruskal-Wallis test.

Prior to conducting the regression analyses, key assumptions such as the normality of residuals, homoscedasticity, and autocorrelation were tested to ensure the validity of the models. The normality of residuals was assessed by comparing observed probability distributions with expected normal distributions, while homoscedasticity and autocorrelation were examined using correlation analysis and the Durbin-Watson test.

All analyses were conducted with a significance level of 0.05, except where specifically noted (e.g., a 0.10 significance level for Hypothesis 2). The combination of correlation, regression, and non-parametric tests provided a robust and comprehensive approach to testing the study's hypotheses and understanding the complex relationship between religiosity and entrepreneurial intention across a diverse population.

4. Findings

4.1. Factor and reliability analysis

A factor analysis was conducted for the two composite variables – religious beliefs and entrepreneurial intention, which were computed by averaging the respondents' answers to three questions related to religious beliefs and six questions related to entrepreneurial intention.

The Table 3 presents the results of the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity. Both the KMO and Bartlett's Test results strongly support the suitability of the dataset for factor analysis – a KMO value of 0,879 suggest that the sample size and data are highly appropriate for factor analysis, while Bartlett's Test is significant (p = 0,000).

Table 3: Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,879
Bartlett's Test of Sphericity	Approx. Chi-Square	1185,944
	df	36
	Sig.	,000

Source: Authors

Communalities range from 0,625 to 0,877 (Table 4). These values indicate that each variable is represented by the factors well.

Table 4: Communalities

	Initial	**Extraction**
DUREL_1_IR	1,000	,754
DUREL_2_IR	1,000	,801
DUREL_3_IR	1,000	,780
EIN_1	1,000	,625
EIN_2	1,000	,817
EIN_3	1,000	,849
EIN_4	1,000	,877
EIN_5	1,000	,848
EIN_6	1,000	,829

Extraction Method: Principal Component Analysis

Source: Authors

The two components extracted (associated with an eigenvalue greater than 1) explain 79,772% of the variance (Table 5).

Table 5: Total variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,981	55,347	55,347	4,981	55,347	55,347	4,828	53,639	53,639
2	2,198	24,425	79,772	2,198	24,425	79,772	2,352	26,133	79,772
3	,490	5,442	85,214						
4	,351	3,900	89,115						
5	,299	3,327	92,441						
6	,248	2,760	95,201						
7	,188	2,085	97,286						
8	,125	1,392	98,678						
9	,119	1,322	100,000						

Extraction Method: Principal Component Analysis

Source: Authors

Individual factors are presented in Table 6. The structure of the extracted factors corresponds to the theoretical assumption, i.e. the empirically extracted factors correspond to the theoretical concept of entrepreneurial intention (EIN_composite) and religious belief or values (DUREL_IR_composite).

Table 6: Rotated Component Matrix

Rotated Component Matrix[a]

	Component	
	1	2
DUREL_1_IR		,857
DUREL_2_IR		,888
DUREL_3_IR		,883
EIN_1	,782	
EIN_2	,902	
EIN_3	,910	
EIN_4	,935	
EIN_5	,921	
EIN_6	,906	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 3 iterations.

Source: Authors

The measurement scales' reliability was assessed using the Cronbach's alpha indicator, with a minimum acceptable level of 0,7 (Table 6). DUREL_IR_composite has a Cronbach's alpha of 0,853 with 3 items, which suggests good reliability and indicates that the items consistently measure the intended construct. EIN_composite shows an even higher reliability with a Cronbach's alpha of 0,951 across 6 items, reflecting excellent internal consistency.

Table 7: Reliability analysis

Composite variable	Cronbach's Alpha	N of Items
DUREL_IR_composite	,853	3
EIN_composite	,951	6

Source: Authors

4.2. Research results

Hypothesis 1 (Religious beliefs positively influence entrepreneurial intention) was tested using correlation and regression analysis.

A preliminary correlation analysis of the composite variables DUREL_IR_composite and EIN_composite was conducted to confirm the significance and direction of the relationship between religious beliefs and entrepreneurial intention (Table 7).

Table 8: Correlation between the composite variables EIN_composite and DUREL_IR_composte

			EIN_composit	DUREL_IR_composit
Spearman's rho	EIN_composite	Correlation Coefficient	1,000	,165*
		Sig. (2-tailed)	.	,040
		N	156	156
	DUREL_IR_composite	Correlation Coefficient	,165*	1,000
		Sig. (2-tailed)	,040	.
		N	156	156

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Authors

The results in Table 7 show a weak but statistically significant positive correlation between religious beliefs and entrepreneurial intention, which justified proceeding with regression analysis to further explore the nature and strength of this relationship.

During the regression analysis, the normality of the residual distribution, as well as the presence of heteroscedasticity in the residual variance and residual autocorrelation, were examined.

The regression model suggests that religious beliefs, as measured by DUREL_IR_composite, have a statistically significant yet weak impact on entrepreneurial intention. The regression model also yielded an R^2 value of 0,031, indicating that 3,1% of the variance in entrepreneurial intention is explained by religious beliefs (Table 8).

Table 8: Model summary (DUREL_IR_composite – ENT_composite)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,177[a]	,031	,025	1,08656	2,007

a. Predictors: (Constant), DUREL_IR_composite
b. Dependent Variable: EIN_composite

Source: Authors

The ANOVA results (Table 9) demonstrate that the regression model is statistically significant, suggesting that religious beliefs, as measured by DUREL_IR_composite, have a significant impact on entrepreneurial intention.

Table 9: ANOVA (DUREL_IR_composite – ENT_composite)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5,878	1	5,878	4,979	,027[b]
	Residual	181,815	154	1,181		
	Total	187,693	155			

a. Dependent Variable: EIN_composite
b. Predictors: (Constant), DUREL_IR_composite

Source: Authors

The results from Table 10 indicate that religious beliefs have a positive and significant effect on entrepreneurial intention. Specifically, as religious beliefs increase, entrepreneurial intention also increases, though the effect size is relatively small.

Table 10: Coefficients (DUREL_IR_composite – ENT_composite)

Coefficients[a]

Model		Unstandardized Coefficients		Standardizedt Coefficients		Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	2,671	,310		8,604	,000	2,058	3,285
	DUREL_IR_composite	,184	,083	,177	2,231	,027	,021	,347

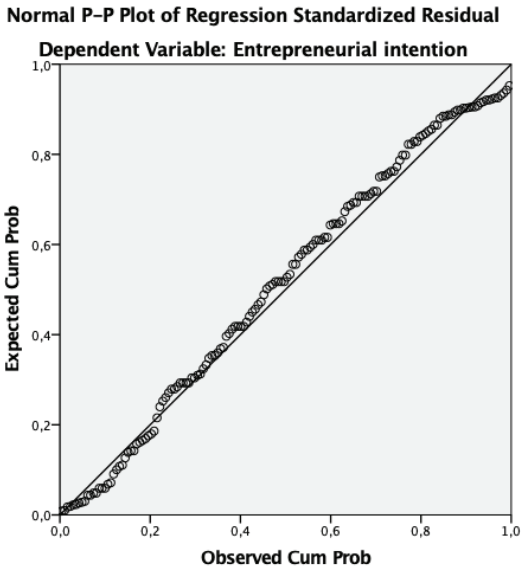
a. Dependent Variable: EIN_composite

Source: Authors

The Durbin-Watson test, shown in Table 8, has a value of 2,007. This test assesses autocorrelation in the residuals, and a value close to 2 indicates that there is no significant autocorrelation.

The assumption of residual normality is confirmed by the observed probability distribution function (Figure 1), which closely aligns with the expected probability function if the residual deviations were normally distributed (represented by the diagonal line on the graph).

Figure 1: P-P plot – normally distributed residuals (DUREL_IR_composite – ENT_composite)



Source: Authors

The correlation analysis shows no significant relationship between DUREL_IR_composite and the absolute residuals (abs_RES1), indicating that the homoscedasticity assumption is met (Table 11).

Table 11: Correlation between the composite variable DUREL_IR_composite and absolute residuals

			DUREL_IR_composite	abs_RES1
Spearman's rho	DUREL_IR_composite	Correlation Coefficient	1,000	-,070
		Sig. (2-tailed)	.	,382
		N	156	156
	abs_RES1	Correlation Coefficient	-,070	1,000
		Sig. (2-tailed)	,382	.
		N	156	156

Source: Authors

Although the effect of religious beliefs on entrepreneurial intention is modest in our model, it **supports the Hypothesis 1 that religious beliefs positively influence the entrepreneurial intention**.

Hypothesis 2 (Specific religious values (e.g., religious rituals) significantly impact entrepreneurial intention) was tested using correlation and regression analysis.

The analysis suggests that specific religious practices – organizational religious activity (ORA) and non-organizational religious activity (NORA) – do not have a significant relationship with entrepreneurial intention in this sample at the 5% significance level. However, it can be noted that organizational religious activity (ORA) shows a weak positive correlation with entrepreneurial intention that is significant at the 10% significance level (p = 0,066), indicating a potential trend that may warrant further investigation.

Table 12: Correlation between the composite variables EIN_composite, DUREL_4_ORA and DUREL_5_NORA

			EIN_composite	DUREL_4_ORA	DUREL_5_NORA
Spearman's rho	EIN_composite	Correlation Coefficient	1,000	,148	,041
		Sig. (2-tailed)	.	,066	,610
		N	156	156	156
	DUREL_4_ORA	Correlation Coefficient	,148	1,000	,426**
		Sig. (2-tailed)	,066	.	,000
		N	156	156	156
	DUREL_5_NORA	Correlation Coefficient	,041	,426**	1,000
		Sig. (2-tailed)	,610	,000	.
		N	156	156	156

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Authors

To test Hypothesis 2, a regression analysis was conducted using the stepwise method. During the analysis, the variable DUREL_4_ORA, representing organizational religious activity, was included in the regression model, indicating its significance in predicting entrepreneurial intention. However, the analysis revealed the presence of heteroscedasticity in the residual variance, as shown in Table 13.

Table 13: Correlation between the composite variable DUREL_4_ORA and absolute residuals

			DUREL_4_ORA	abs_RES2
Spearman's rho	DUREL_4_ORA	Correlation Coefficient	1,000	-,177*
		Sig. (2-tailed)	.	,027
		N	156	156
	abs_RES2	Correlation Coefficient	-,177*	1,000
		Sig. (2-tailed)	,027	.
		N	156	156

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Authors

Based on the correlation analysis results, Hypothesis 2 can be partially accepted, suggesting that a positive relationship between specific religious values, particularly those related to

organizational religious activity, and entrepreneurial intention can be expected at the 10% significance level. This finding indicates that while the relationship is not strong, organizational religious practices may be associated with higher entrepreneurial intentions, warranting further investigation in future studies. Non-organizational religious activity, however, showed no significant effect on entrepreneurial intention, indicating that private religious practices do not influence entrepreneurial intention in this sample.

The Kruskal-Wallis test was used to examine Hypothesis 3 and Hypothesis 4.

Since the p-value (0,647) is greater than the 0,5 significance level, the test indicates that there is no statistically significant difference in entrepreneurial intention across different religious communities. Thus, Hypothesis 3 cannot be accepted, suggesting that religious community membership does not significantly affect entrepreneurial intention in this sample.

Table 14: Kruskal Wallis Test – Religion - EIN

Test Statistics[a,b]

	EIN_composite
Chi-Square	,870
df	2
Asymp. Sig.	,647

a. Kruskal Wallis Test
b. Grouping Variable: RELIGION

Source: Authors

The results of the Kruskal-Wallis test for Hypothesis 4 reveal that entrepreneurial intention does not vary significantly among individuals from different cultural backgrounds, since the p-value is much higher than the conventional 0,05 significance level (Table 15).

Table 15: Kruskal Wallis Test – Citizenship - EIN

Test Statistics[a,b]

	EIN_composite
Chi-Square	,632
df	2
Asymp. Sig.	,729

a. Kruskal Wallis Test
b. Grouping Variable: CITIZENSHIP

Source: Authors

5. Conclusion

Hypothesis 1, that religious beliefs positively influence entrepreneurial intention, is supported based on the research results of 150 young people in Croatia, Bosnia and Herzegovina and Serbia. However, the correlation coefficient of 0,165 denotes a weak relationship, implying that while religious beliefs may influence entrepreneurial intention, the effect is minimal. It is

essential to consider other factors that might also affect entrepreneurial intention. This finding highlights the complexity of entrepreneurial intention and underscores the need to explore additional variables that may have a stronger predictive effect. These findings support Hypothesis 1, suggesting that religious beliefs do influence entrepreneurial intention to some extent. However, the low explained variance indicates that other factors are likely more influential.

Hypothesis 2 is partially supported, as the analysis suggests a positive relationship between entrepreneurial intention (EIN) and religious values measured through organizational religious activity (ORA). This relationship is statistically significant at the 10% level (p = 0,066). The trend indicates that organizational religious practices may influence entrepreneurial intention. In contrast, non-organizational religious activity (NORA) was found to have no significant relationship with entrepreneurial intention (p = 0,610), indicating that private religious practices do not affect entrepreneurial intention in this sample.

Hypothesis 3 is not supported. This outcome implies that factors other than religious community membership may have a stronger effect on entrepreneurial intention and religious affiliation alone does not create substantial differences in entrepreneurial behavior. Hypothesis 4 also cannot be accepted, indicating that cultural background, as measured by citizenship, is not a determining factor in entrepreneurial intention within this sample. This suggests that cultural differences related to citizenship may not play a significant role in shaping individuals' intentions to engage in entrepreneurial activities.

6. Research limitations and directions for future studies

This study was conducted in a relatively similar cultural environment in in the three Balkan countries, which may have influenced the research results, as most of the respondents were born and raised in the same cultural environment despite having different cultures and religions. In addition, for the purposes of this research, it was difficult to reach more respondents from Judaism, Hinduism, Protestantism or other world religions. It is possible that these more distant religions than those represented in this part of Europe may produce different or opposite results. One of the directions for future research will therefore be to expect a much larger sample and a much wider range of world religions, taking into account different religions and cultural contexts. Since entrepreneurship is still not a particularly desirable career choice for adults in the three Balkan countries, a different cultural context could also lead to the opposite results.

REFERENCES

Adamu, I. M. and Mansur, M. S. (2018). ***An Overview of Entrepreneurial Motivation from the Perspective of Developing World,*** GOUni Journal of management and social sciences, Vo. 4, No. 2, pp. 250-262.

Ajzen, I. (1991): ***The theory of planned behavior***, Organizational Behavior and Human Decision Processes, Vol. 50, No. 2, pp. 179-211.

Ajzen, I. (2002): ***Perceived Behavioral Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behavior***, Journal of Applied Social Psychology, Vol. 32, No. 4, pp. 665-683.

Anwar, G. and Abdullah, N. N. (2021): ***The Impact of Human Resource Management Practice on Organizational Performance***. International Journal of Engineering, Business and Management (IJEBM), No. 5, pp. 35-47. https://doi.org/10.22161/ijebm.5.1.4

Bacq, S., Bal, M., and Habib, R. (2020): ***Religion and social entrepreneurship: A systematic review and meta-analysis***. Journal of Business Ethics, Vol. 166, No. 1, pp. 1-22.

Bilić, I., Prka, A., and Vidović, G. (2011): ***How does education influence entrepreneurship orientation? Case study of Croatia***, Management: Journal of Contemporary Management Issues, Vol. 16, No. 1, pp. 115-128.

Bubalo, L. (2023): An Introduction to the Legal Cultures of Bosnia and Herzegovina, Croatia, and Serbia (Western Balkan). In: Koch, S., Kjølstad, M.M. (eds) Handbook on Legal Cultures. Springer, Cham.

Carsrud, A. L., and Brännback, M. (2014). ***Linking achievement motivation to intentions, goals and entrepreneurial behaviors***. In J. Mitchell, R. K. Mitchell, & B. Randolph-Seng (Eds.), ***Handbook of Entrepreneurial Cognition*** (pp. 86-112). Cheltenham, Ujedinjeno Kraljevstvo: Edward Elgar Publishing Limited.

Cornelius A. Rietveld, C. A. and Hoogendoorn, B. (2022): ***The mediating role of values in the relationship between religion and entrepreneurship***, Small Bus Econ, Vol. 58, pp. 1309–1335. https://doi.org/10.1007/s11187-021-00454-z

Djordjevic, D., Cockalo, D., Bogetic, S., & Bakator, M. (2021): ***Predicting Entrepreneurial*** Intentions among the Youth in Serbia with a Classification Decision Tree Model with the QUEST Algorithm**,** Mathematics, Vol. *9*, No. 13, p. 1487. https://doi.org/10.3390/math9131487

Esfandiar, K., Sharifi-Tehrani, M., Pratt, S., Altinay, L. (2019): ***Understanding entrepreneurial intentions: A developed integrated structural model approach***, Journal of Business Research, Vol. 94, pp. 172-182. https://doi.org/10.1016/j.jbusres.2017.10.045.

Fayolle, A. i Liñán, F. (2014):***The future of research on entrepreneurial intentions***, Journal of Business Research, Vol. 67, No. 5, pp. 663-666, https://doi.org/10.1016/j.jbusres.2013.11.024

Giacomin, O., Janssen, F., Shinnar, R. S., Gundolf, K. and Shiri, N. (2022): ***Individual religious affiliation, religiosity and entrepreneurial intentions among students in four countries,*** International Small Business Journal, Vol. *41*, No. 3, pp. 318-346. https://doi.org/10.1177/02662426221097910 (Original work published 2023)

Hill, S. DSc (Lead Author), Ionescu-Somers, A. PhD and Coduras, A. PhD GEM Global, Hill, https://www.gemconsortium.org/reports/latest-global-report, (accessed 28 March 2025)

Koenig, H. G., Büssing, A. (2010): ***The Duke University Religion Index (DUREL): A Five-Item Measure for Use in Epidemiological Studies,*** Religions, Vol. 1, pp. 78-85. https://doi.org/10.3390/rel1010078

Krueger, N., F.; Reilly, M., D. and L. Carsrud, A., L. (2000): ***Competing models of entrepreneurial intentions***, Journal of Business Venturing, Vol. 15, No. 5–6, pp. 411-432. https://doi.org/10.1016/S0883-9026(98)00033-0.

Liñán, F., & Chen, Y. (2009): ***Development and Cross – Cultural Application of a Specific Instrument to Measure Entrepreneurial Intentions***, Entrepreneurship Theory and Practice, Vol. 33, No. 3, pp. 593-617. https://doi.org/10.1111/j.1540-6520.2009.00318.x

McIntyre, N., Quaye, E., S., Anning-Dorson, T., Lanivich, S. and Adomako, S. (2023): ***Investigating the impact of religiosity on entrepreneurial intentions,*** Journal of Business Research, Vol. 156, 113528, ISSN 0148-2963, https://doi.org/10.1016/j.jbusres.2022.113528.

Morić Milovanović, B., Krišto, T., & Srhoj, S. (2015): ***Što razlikuje studente s poduzetničkim namjerama? Analiza empirijskog modela odrednica poduzetničkih namjera među studentima Sveučilišta u Zagrebu***, *Ekonomska misao i praksa,* No. 1, pp. 151-170.

Musallam, A. H. and Kamarudin, S. (2021): ***Religiosity and Entrepreneurship: A Systematic Review and Future Research,*** Special Issue: Managing Economic Growth in Post COVID Era: Obstacles and Prospects, Vol. 9., No. 34, DOI: http://dx.doi.org/10.25115/eea.v39i4.4171

Nikolić Tošović, M. and Jovanović, V. (2021): ***Entrepreneurial Intention Model: Empirical Results with Management Students in Serbia,*** Management Journal of Sustainable Business and Management Solutions in Emerging Economies, Vol. 26, No. 2, pp. 15-28. DOI: 10.7595/management.fon.2020.0023

Nino, I., J., Dioh, S., S. and Fanggidae, J., P. (2022): ***The relationship between religiosity and entrepreneurship interest. mediation roles of belief in upper power and fear of entrepreneurship,*** Enrichment: Journal of Management, Vol. 12, No. 5, pp. 4415-4420.

Petković, S. (2017): ***University Students' Entrepreneurial Intentions: Insights From BIH (Republic of Srpska)***, Acta Economica, Vol. 15, No 27 https://doi.org/10.7251/ACE1727059P

Popov, B., Mijatović, D., and Matanović, J. (2023): ***Šta predviđa preduzetničku nameru kod studenata? Doprinos Teoriji planiranog ponašanja,*** Psihološka istraživanja, Vol. XXVI, N. 1, pp. 7–25. DOI: 10.5937/PSISTRA26-40837

Šestić, M., Bičo Ćar, M., Pašić-Mesihović, A. and Softić, S. (2017): ***Entrepreneurial Intentions of Business Studies Students in Bosnia and Herzegovina,*** Obrazovanje za poduzetništvo - E4E*,* Vol. 7, No. 2, 0-0. https://hrcak.srce.hr/191721

Shapero, A., and Sokol, L. (1982): ***The Social Dimensions of Entrepreneurship***. In C. A.

Kent, D. L. Sexton, & K. H. Vesper (Eds.), ***Encyclopedia of Entrepreneurship*** (pp. 72-90). Englewood Cliffs, New Jersey: Prentice-Hall.

Singer, S., Šarlija, N., Pfeifer, S., & Oberman Peterka, S. (2017): ***Što čini Hrvatsku (ne)poduzetničkom zemljom? GEM Hrvatska 2016***. Zagreb: CEPOR – Centar za politiku razvoja malih i srednjih poduzeća i poduzetništva.

Toledano, N. (2019). ***Looking for god, meaning, physical fitness and beyond: the religious and spiritual space in sport entrepreneurship,*** International Entrepreneurship and Management Journal, Vol. 16, No. 3, pp. 897-916, DOI: 10.1007/s11365-019-00619-z

Turulja, L., Veselinovic, L., Agic, E., & Pasic-Mesihovic, A. (2020): ***Entrepreneurial intention of students in Bosnia and Herzegovina: what type of support matters?*** Economic Research-Ekonomska Istraživanja, Vol. *33, No.* 1, pp. 2713–2732. https://doi.org/10.1080/1331677X.2020.1730216

Weber, M. The Protestant Ethic and the Spirit of Capitalism in New Introduction and Translation by Stephen Kalberg Boston University, (2012), Routledge; New York

Woodside, A.G., Megehee, C.M., Isaksson, L. and Ferguson, G. (2020): ***Consequences of national cultures and motivations on entrepreneurship, innovation, ethical behavior, and quality-of-life,*** Journal of Business & Industrial Marketing, Vol. 35 No. 1, pp. 40-60. https://doi.org/10.1108/JBIM-10-2018-0290

Zovko, L., Bilić, I. and Dulčić, Ž. (2020): ***Determinants of students' entrepreneurial intention: An empirical research,*** Management, Vol. 25 , No. 1, pp. 25-44. https://doi.org/10.30924/mjcmi.25.1.2

A scientific paper

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THE IMPACT OF THE HYBRID WORK MODEL ON BUSINESS COMMUNICATION

ABSTRACT

This paper examines key communication skills in a hybrid work environment and explores the impact of work models on business communication. It also provides an overview of existing research and studies focusing on challenges and adaptations in organizational communication methodologies with a hybrid work model, particularly in digital literacy, self-management, virtual teamwork skills, and communication skills, which are key success factors. The research methodology is based on the quantitative analysis of the data collected by the survey. A structured survey with predefined questions was used, ensuring the standardization of responses and facilitating data analysis. The survey was online, and participation was voluntary and anonymous with 144 respondents. Data were analyzed using quantitative techniques, including descriptive and inferential analyses in SPSS to discern patterns and trends. The results indicate that utilizing digital tools particularly video conferencing, has a significant and positive impact on the effectiveness of business communication.
In contrast, although other frequently used tools did not show the same level of association with communication effectiveness. Additionally, generational differences influence preferences for using digital tools. Younger employees are more likely to utilize project management platforms and cloud document sharing than their Generation X counterparts. Practical communication skills are crucial among employees with longer employment experience. In comparison, younger employees report greater challenges in self-management and motivation. The research results underscore the importance of continually developing educational programs that enhance key skills for successful functioning in a hybrid work environment, as well as the need for organizations to adapt their communication strategies to increase employee efficiency and productivity.

Key words: *Organization, Business communication, Remote work, Hybrid work model.*

1. Theoretical starting points

1.1. Defining the concept of communication and the hybrid work model

Adopting a hybrid communication model is an important element that enables flexibility and efficiency. In the paper *Hybrid Workplace: The Future of Work*, the hybrid work model is defined as a combination of physical and virtual workspaces and virtual work (Iqbal, Khalid, and Barykin, 2021).

This arrangement may also involve the same group of people physically visiting the company's location on certain days and working remotely for the remainder of the week. The hybrid work system enables organizations to enjoy the unique benefits of remote work, including flexibility at work, reduced labor costs, increased worker satisfaction, and improved environmental conditions. As part of a hybrid work model remote work offers the convenience of working from anywhere in the world. It also saves commuting time due to traffic and creates a more pleasant working environment.

In the paper titled *Remote Work and Work-Life Balance: Lessons Learned from the COVID-19 Pandemic and Suggestions for HRD Practitioners* define hybrid work as a work arrangement that allows employees to alternate performing tasks outside and within the main office, using information and communication technologies to interact with others inside and outside their organization (Shirmohammadi, Au, and Beigi, 2022). This enables flexibility in terms of time and place of work, as employees can alternate between working from home and in the office during the week.

The work *Hybrid Work: Definition, Origins, Debates, and Outlook* defined the hybrid work model as a form of work arrangement in which the worker works sustainably either alone or with others with an agreement between the worker and the organization and respecting the organization, needs and tasks of workers and context (Vartiainen & Vanharanta, 2023).

This allows for flexible working hours and a more adaptable workplace. Employees can work either at the employer's location or remotely from home, other locations, or on the move, utilizing digital technologies such as laptops, mobile phones and the Internet (Shirmohammadi et al., 2022).

It concluded that the hybrid work model enables flexibility in choosing the place and time of work and a balance between business obligations and personal life, focusing on clear and effective communication. The aforementioned requires the development of strategies for leading, motivating, and engaging employees who work in this form and at different locations. Furthermore the hybrid work model requires a high degree of digital literacy. Management and employees adapt to and utilize communication tools and platforms that facilitate the flow of work processes and respect the organizational culture.
The hybrid work model fosters the development of innovative theoretical approaches within communication studies and provides opportunities to examine how various communication styles and techniques impact productivity, job satisfaction and interpersonal relationships. Effective communication is crucial in preparing and implementing strategies for managing hybrid teams and fostering cohesion within diverse and geographically dispersed organizations. The title *Hybrid Work: Definition, Origins, Debates and Outlook* is a working paper of the European Foundation for the Improvement of Living and Working Conditions (Vartiainen & Vanharanta, 2023).

1.2. History of communication

For a successful business and progress it is important to establish quality and effective communication. Communication is an interdisciplinary and multidisciplinary field. It provides insight into the nature of human interaction. In the 20th century, electronic media shaped society, and the advancement of high technologies led to the third information and communication revolution. Communication theory defines the concept of information and underscores the significance of communication in connecting diverse segments of society through the exchange of information (Hardt, 2008). In the 21st century, the Internet transmits digitized information enriched with sound and images and is the dominant means of transmitting information globally.

1.3. The communication process in the context of the hybrid work model

In the modern globalized world, the history of communication and the evolution of work models, such as the hybrid work model, are interconnected, illustrating how technological progress and changes in communication shape how we work and collaborate. Technology, digitization, and networking are key to influencing hybrid work. Digital tools and platforms allow for real-time collaboration and communication. This has fundamentally changed how organizations think about workspace and team management.

As hybrid work encompasses a blend of physical presence in office spaces and remote work, we are witnessing significant transformations in business communication. Global health challenges such as the COVID-19 pandemic have further accelerated the adoption of this approach to work. Understanding communication processes helps tackle issues such as managing diverse teams, preserving corporate culture and engaging remote employees.

The work *Hybrid Work: Definition, Origins, Debates, and Outlook* examines how hybrid work models require advanced communication strategies and tools for effectively overseeing dispersed teams (Vartiainen & Vanharanta, 2023).
The paper *Hybrid Workplace: The Future of Work* addresses the concept of the hybrid workplace as a response to technological changes and global trends (Iqbal et al., 2021). In the context of communication, hybrid work models necessitate advanced communication strategies and tools for effectively managing dispersed teams.

The hybrid work model gives rise to new communication interactions that can encompass a combination of virtual meetings, asynchronous messaging, and traditional face-to-face meetups. Technological progress and shifts in communication practices have profoundly impacted how work and collaboration are conducted in the modern, globalized world.

1.4. Business communication in the organization, including the hybrid work model

If employees are not motivated or ready for change, organizations and the managers who lead them encounter obstacles, as employees play a crucial role in the innovation process within organizations, including creativity and tolerance for change. Following the COVID-19 pandemic, the boundaries between professional and personal domains have become increasingly blurred, resulting in workplace conflicts and increased stress.

Employees seek jobs that provide adaptability in managing their work-life integration balance. For the younger generation, achieving a balance has become a priority. Organizations that fail to address these needs face difficulty in acquiring and retaining talented employees. Managing an organization that strives for a hybrid work model requires managers to develop new motivation and leadership techniques, as collaboration and decision-making often occur virtually.

In the work *Remote Work and Work-Life Balance: Lessons Learned from the COVID-19 Pandemic and Suggestions for HRD Practitioners* identify several key points related to business communication in a hybrid work environment (Shirmohammadi et al., 2022). To foster trust and effective collaboration within distributed teams, it is crucial to create an environment where all team members have access to the same information, thereby maintaining alignment and engagement.

Working in a hybrid model requires adapting to various communication protocols and accommodating employees' diverse individual work styles. Methodology guarantees that organizations adapt and are resilient to change. The emphasis on integration and inclusion ensures that digital communication does not foster a sense of exclusion among employees, but instead promotes a sense of value and inclusion. Educating employees on the use of communication tools necessary for effective functioning is important. Organizational structures must function effectively, regardless of physical distance, as hybrid work remains a prevalent feature of modern business.

Emphasize that hybrid work requires organizations to reconceptualize their communication strategies to remain effective despite their teams' geographical and temporal dispersion (Vartiainen & Vanharanta, 2023). Communication is essential for building trust fostering innovation and maintaining team cohesion. Organizations must develop the ability to lead and motivate teams through digital channels which necessitates new skills and approaches in management and leadership.
Effective communication in hybrid work environments relies on the organization's ability to integrate appropriate technologies that support both asynchronous and synchronous communication. Success depends on how well an organization can ensure a continuous flow of information and establish norms and expectations that regulate communication.

A culture where all employees are well informed and involved reduces feelings of isolation. Organizations implementing hybrid work models often combine traditional and innovative communication tools to keep their teams motivated and focused on common goals. The hybrid work is organizational communication.

1.5. Organizational behavior related to the hybrid work model

In the context of organizational behavior, the focus is on analyzing how individuals, groups, and structural elements influence organizational performance (Griffin, Phillips, and Gully, 2020). This is crucial for understanding and improving effectiveness through a detailed examination of three key determinants of behavior: individuals, groups, and organizational structures. Organizational behavior enables managers to apply a scientific approach to improve functionality, innovation and competitiveness in a dynamic global marketplace (Robbins & Judge, 2013).

Combining elements of traditional workplace presence with the flexibility of remote work has led to significant changes in team dynamics, communication, employee engagement, and corporate culture. Introducing hybrid work models has reshaped traditional work practices affecting all aspects of organizational behavior from communication and collaboration to motivation and organizational culture. For organizations it is essential to continuously integrate adaptive work models to achieve benefits in productivity, innovation and employee satisfaction.

1.6. Groups and teams involved in a hybrid work model

A group is a collection of at least two people who cooperate and depend on each other to achieve specific tasks (Griffin et al., 2020). These groups may be formal, structured within an organizational hierarchy with defined tasks that contribute to organizational goals, or informal, arising spontaneously to fulfill social needs. Teams are a specific type of formal group characterized by shared objectives and interdependence regarding information, resources, and skills.

Not every group can be considered a team, although every team constitutes a group. Team is defined as a small number of individuals who share common goals and act in a coordinated manner to achieve them (Lamza-Maronić & Glavaš, 2008). This distinction is crucial in the context of organizational behavior as teams play a vital role in completing complex tasks through collaboration, shared responsibility, and mutual support. In hybrid work environments, the dynamics within teams become even more complex due to spatial and technological dispersion, requiring advanced coordination and communication strategies.

Various team organizations may implement, including functional, cross-functional, problem-solving, autonomous, virtual, and global teams (Griffin et al., 2020). These teams rely heavily on telecommunications and information technologies to sustain collaboration and cohesion despite geographical and organizational separation. Managers and team leaders must develop advanced skills in managing digital and virtual collaboration including establishing clear communication protocols, providing effective feedback and fostering a culture of openness and transparency.

Addressing isolation among remote team members and preserving work-life balance is essential to prevent burnout. Understanding and effectively managing teams in hybrid models has become crucial for sustaining innovation and competitiveness. Organizations that master this position position themselves as adaptive leaders in the global business environment.

A field experiment showed that employees who worked approximately two days per week in the office reported higher job satisfaction and better work-life balance than those who worked more or fewer days (Choudhury, Khanna, Makridis, and Schirmann, 2023). This balance between remote and office work had a positive influence on employees' perception of their work environment. Findings indicated improved creativity and work quality, especially among managers suggesting that moderate remote work can enhance performance without compromising productivity.

Furthermore, hybrid work models offer flexibility in commuting and working hours, contributing to employee well-being. These insights reinforce the view that hybrid models foster productivity, innovation and retention of talented employees.

1.7. The impact of technology on business communication in a hybrid work model

Through the lens of business communication, organizations utilize technology to achieve their strategic goals, particularly during times of disruption. The shift to online platforms such as Microsoft Teams, Google Meet and Zoom became critical during the COVID-19 pandemic ensuring business continuity despite physical restrictions.
Technology enabled the transition to hybrid work models and inspired a cultural shift. New practices emerged requiring adjustments in communication and collaboration. Surveys show that many employees prefer hybrid arrangements due to improved work-life balance reduced stress and increased focus when working from home. However, challenges such as meeting organization and ensuring equal participation across locations persist.

Team leaders must be trained to facilitate communication and maintain organizational alignment regardless of physical location. Hybrid work fosters flexible engagement that is aligned with business expectations. Implementing clear policies and adapting organizational practices are key to successful model integration.

Microsoft Teams categorizes hybrid work into four models: flexible, fixed, office-prioritized, and remote-prioritized. In flexible models, employees choose their schedules; in fixed models, schedules are predetermined. Office-based models emphasize in-person work, whereas remote-first models prioritize remote work.

A 2022 Owl Labs study found that hybrid and remote employees report higher levels of happiness and job retention compared to office-based workers. These employees experience lower stress, higher productivity, and better physical and mental well-being. A similar study by Ergotron (2022) confirmed that hybrid or remote work improves mental health, work-life balance, and daily activity levels. Employees appreciate the flexibility, which contributes to job satisfaction.
Prodoscore's research (2020) showed that productivity is not necessarily tied to physical presence. Employees who were productive in the office maintained their performance remotely while lower-performing employees remained less productive regardless of location.
Despite these advantages, hybrid work presents leadership challenges. Managers often face tensions between organizational demands and employee needs lacking the authority or tools to implement change. Inadequate engagement in meetings indicates flaws in communication strategies. Organizations should develop more explicit work norms and refine their organizational structure.
Technological adaptation is essential for positive work environments, satisfaction and productivity. A *study on Zoom fatigue* demonstrated that frequent video conferencing contributes to exhaustion, negatively impacting communication efficiency (Fauville et al., 2021). They found that meeting frequency, duration and intensity (burstiness) are key factors in fatigue.
These findings underscore the importance of managing digital meeting dynamics and reevaluating organizational communication to promote employee well-being. This research contributes to shaping more efficient, balanced and humane communication practices in hybrid work environments.

2. Research related to the influence of the hybrid model of work on business communication

2.1. The aim of research

This paper examines the adaptation of business communication to the hybrid work model, taking into account the impact of various communication tools and methods. It also examines the development of key communication skills and analyzes the obstacles and challenges that impact the effectiveness of business communication in hybrid work environments. Special emphasis is placed on investigating variations in the adaptation and effectiveness of business communication among employees, including sociodemographic factors such as gender, age, industry of employment, and work experience. This approach aims to identify and propose strategies that help organizations optimize their communication processes to enhance productivity and employee satisfaction in hybrid work environments.

Hypothesis:

H1: The use of cloud services, instant messaging apps, video conferencing platforms, and tools for digitizing processes significantly increases the efficiency of business communication in the hybrid work model where preferences for specific tools vary depending on the sociodemographic factors of the employees.

H2: Key skills necessary for success in a hybrid work environment, including digital literacy, self-management, virtual teamwork skills and communication skills are perceived as necessary to varying degrees depending on the age, industry of employment and work experience of the employees.

H3: Major barriers to effective business communication in the hybrid work model such as technical problems, Zoom fatigue and challenges in preserving organizational culture have varying impacts on employees, depending on their industry and work experience and pose a challenge in building and maintaining professional relationships.

2.2. Research method and research sample

By conducting the research through a quantitative survey, data were collected regarding the impact of digital tools and skills on the effectiveness of business communication in a hybrid work model. A structured questionnaire with predefined questions was employed, which enabled the standardization of responses and facilitated subsequent data analysis. The survey was disseminated through social networks, including LinkedIn and Facebook. For the analytical phase, the SPSS statistical software was utilized, and both descriptive and differential statistical analyses were performed to identify patterns and trends within the data. The sample consisted of 144 respondents selected through random sampling. All participants were informed about the purpose of the research, and participation was voluntary and anonymous.

The respondents were categorized according to generational cohorts and gender as follows:
Generation Z (under 27 years): 15 respondents (5 males, 10 females), comprising 10.4% of the total sample.
Millennials (28–43 years): There were 78 respondents (30 males, one who preferred not to answer, and 47 females), representing the largest generational group at 54.2% of the total sample. While this group is more evenly distributed by gender, females are more represented.

Generation X (44–59 years): 50 respondents (18 males, 32 females), accounting for 34.7% of the sample.
Baby Boomers (60 years or older): 1 respondent (1 male), representing the smallest generational group at 0.7%.

Table 1: Generational cohort and gender

Generation	Total	Male	Female	Undisclosed	% of Sample
Generation Z	15	5	10	0	10.4%
Millennials	78	30	47	1	54.2%
Generation X	50	18	32	0	34.7%
Baby Boomers	1	1	0	0	0.7%
Total	144	54	89	1	100%

Source: Authors

A total of 144 respondents participated in the survey, offering insight into various employment sectors, job roles, levels of work experience, generational affiliation, and the period of initial employment within their organizations. The most represented sectors were finance (54 respondents) and technology (36 respondents) with other industries such as education, marketing, retail and public administration moderately represented.

Additionally the survey encompassed participants from other sectors with fewer representatives, contributing to diverse perspectives.

Table 2: Industry of current employment

Industry of current employment	Number
Finance	54
Technology	36
Other	11
Marketing and communications	9
Education	8
Healthcare	7
Retail	6
Manufacturing	5
Public service and administration	3
Construction	3
Hospitality and tourism	2
Total	144

Source: Authors

In terms of organizational roles, the majority of participants were employed at middle management and specialist levels (90 respondents). Furthermore, there were 13 entrepreneurs or business owners, 13 junior-level employees, and 16 respondents who held senior management positions. This distribution reflects a sample with a strong representation from operational and managerial tiers thus enabling relevant insights into organizational communication processes.

Table 3: Current position in the organization

Current position in the organization	Number
Middle management / Specialist	90
Senior management / Executive	16
Entry level / Junior	13
Business owner / Entrepreneur	13
Other	7
Independent professional / Freelancer	5
Total	144

Source: Authors

Regarding work experience, the largest subgroup of participants reported between 11 and 20 years of experience (53 respondents), followed by those with over 20 years of experience (48 respondents). Notably, Millennials (aged 28–43) were the most prevalent across all experience categories, totaling 78 participants. Generation X included 50 respondents, while Generation Z comprised 15, predominantly within the shorter experience categories.

Only one participant belonged to the Baby Boomer group (60 years or older).

Table 4: Work experience with the age group

Work experience / Age group	**Number**
Less than 1 year	4
Generation Z: Under 27 years old	4
1–5 years	17
Generation Z: Under 27 years old	9
Millennials (28–43 years old)	8
6–10 years	22
Generation Z: Under 27 years old	2
Millennials (28–43 years old)	20
11–20 years	53
Generation X (44–59 years old)	10
Millennials (28–43 years old)	43
More than 20 years	48
Baby Boomers (60+ years old)	1
Generation X (44–59 years old)	40
Millennials (28–43 years old)	7
Total	144

Source: Authors

As for the initial employment period, 85 respondents commenced work before the COVID-19 pandemic, 24 began during the pandemic, and 35 started afterward. These data illustrate a natural transition from traditional to contemporary work modalities, providing essential context for understanding shifts in efficiency, communication practices, and the application of digital skills within the hybrid work model.

Table 5: Start Period in Current Organization

Start period in the current organization	Number
Before the COVID-19 pandemic	85
After the COVID-19 pandemic	35
Employed during the COVID-19 pandemic	24
Total	144

Source: Authors

The demographic profile of the sample comprises a heterogeneous group of professionals across diverse industries, generations, and organizational hierarchical levels. This heterogeneity significantly enriched the analysis of hybrid work's impact on communication processes, digital transformation, and organizational behavior in the evolving work environment.

2.3. Data analysis of Hypothesis 1 (H1)

Hypothesis H1 posits that the use of digital tools (cloud services, messaging apps, video conferencing, and digitization tools) increases the efficiency of business communication in hybrid work, and that tool preferences vary according to sociodemographic characteristics.

The analysis revealed that only the frequency of video conferencing use had a statistically significant impact on communication efficiency ($p < 0.05$). Other tools showed no such impact, likely due to uniform use across respondents. Non-parametric regression was employed because the data had a non-normal distribution. No statistically significant gender differences were found. Millennials used cloud project management and document-sharing tools significantly more often than Generation X ($p < 0.05$). At the same time, differences for Generation Z were not statistically significant due to the small sample size.
Thus, H1 is partially confirmed: video conferencing has a positive effect on perceived communication efficiency, and generational differences exist in tool preferences, although not by gender.

2.3.1. Conclusion for Hypothesis 1 (H1)

The analysis of H1 includes two aspects: (1) that using digital tools enhances business communication efficiency, and (2) that preferences vary by sociodemographic characteristics. The findings support that video conferencing tools significantly enhance perceived communication efficiency. While gender differences were not observed, age-related variations, particularly the greater adoption of cloud-based tools by Millennials, were noted. This supports the partial confirmation of H1.

2.4. Data analysis of Hypothesis 2 (H2)

Hypothesis H2 suggests that key skills required for success in a hybrid work environment digital literacy, self-management, virtual teamwork, and communication are perceived differently across different age groups, employment industries and work experiences.
Chi-square tests showed no significant difference in perceptions of most skills across different work experience levels. However, communication skills were perceived as significantly less important by employees with up to five years of experience ($p < 0.05$), and more important by those with 6–10 years of experience. Adjusted residual analysis confirmed these findings, with significant values lying outside the -1.96 to +1.96 range.

H2 is partially confirmed: only communication skills showed significant differences by work experience. No differences were observed by age group.

2.4.1. Conclusion for Hypothesis 2 (H2)

Results from chi-square analysis indicate that perceptions of skill importance in hybrid work environments are generally consistent across experience levels, except for communication skills. Employees with 6–10 years of experience tend to assign greater importance to communication skills, whereas those with less than 5 years of experience do not. This implies a need to strengthen communication skill development in less experienced employees to improve efficiency in hybrid models.

2.5. Data analysis of Hypothesis 3 (H3)

Hypothesis H3 proposes that specific challenges in hybrid work, such as technical issues, Zoom fatigue and the erosion of organizational culture, affect employees differently based on age and experience.

Chi-square tests revealed that employees with up to five years of experience reported difficulties with engagement and motivation more frequently than those with more experience ($p < 0.05$). This group was less likely to report a lack of personal contact as a barrier compared to more experienced employees (also $p < 0.05$). Generation X reported significantly more Zoom fatigue than Generation Z.

H3 is partially confirmed. The perception of communication barriers varies by age and experience, particularly in terms of motivation, personal contact and video fatigue.

2.5.1. Conclusion for Hypothesis 3 (H3)

The analysis reveals meaningful differences in how employees perceive communication challenges in hybrid environments. Employees with up to five years of experience report greater difficulty maintaining engagement, while older and more experienced employees are more sensitive to reduced personal contact. Generation X reports higher levels of video call fatigue than Generation Z, indicating generational differences in digital adaptability. These findings confirm that age and work experience significantly influence how communication barriers are experienced and managed in hybrid work environments.

3. Conclusion

Communication continually adapts to business processes, as demonstrated by this comprehensive study, which provides an expanded perspective on the hybrid work model, the role of digital tools in business communication, and employee adaptation. The analysis of Hypothesis 1 (H1) shows that among the tools examined cloud services, instant messaging, video conferencing platforms, and process digitization tools, only video conferencing has a statistically significant positive impact on communication efficiency. Despite frequent use, the other tools did not show a measurable relationship with communication efficiency. This finding emphasizes that not all tools contribute equally. Instead, the specificity and functionality of tools like video conferencing can significantly enhance the effectiveness of communication in hybrid environments. The second component of H1 variation in tool preferences by

sociodemographic factors showed no significant difference based on gender. However, generational differences were observed: Millennials more frequently use cloud-based project management and document-sharing platforms compared to Generation X. This suggests that age-related characteristics influence preferences and usage patterns, underscoring the importance of tailoring technological solutions to employee demographics. Therefore, H1 is partially confirmed, and the results suggest the need for the selective and strategic implementation of communication tools in hybrid organizations.

The analysis of Hypothesis 2 (H2) explored the perceived importance of key skills in a hybrid work environment. Most skills, including digital literacy, self-management, and virtual teamwork, showed no significant differences in perceived importance across different work experience levels. However, communication skills stood out: employees with 6–10 years of experience viewed them as significantly more important, while those with fewer than 5 years of experience rated them lower. These results underscore the importance of tailoring professional development programs to prioritize communication skills, particularly for early-career employees. H2 is therefore partially confirmed, reaffirming the value of continuous targeted upskilling in key areas for hybrid work success.

Hypothesis 3 (H3) examined the barriers to effective communication in hybrid work, including Zoom fatigue, reduced personal contact, and challenges to motivation. Findings indicate that employees with up to five years of experience reported difficulties with motivation and engagement more frequently, but were less affected by reduced personal contact. Conversely, Generation X reported significantly higher levels of video conferencing fatigue compared to Generation Z, which may be attributed to generational differences in their ability to adapt to technology. These insights support the partial confirmation of H3 and highlight the nuanced ways in which demographic variables influence communication barriers.

Effective communication is crucial for enhancing productivity, fostering engagement, and promoting satisfaction in hybrid work environments. In addition to enhancing communication, it is crucial to develop team leadership skills for managing dispersed teams and equipping them with the necessary tools and resources for active participation and a sense of belonging.

The following strategies are proposed:
Training and development: Implement targeted programs to build digital literacy and virtual communication skills, especially for younger employees focused on improving motivation and engagement.

Personalized approach: Apply tailored strategies that consider age, experience, and industry-specific factors to optimize productivity and engagement.

Technological support: Strengthen the quality and usability of digital tools to reduce video call fatigue and enhance internal communication.
Interpersonal relationships: Promote opportunities for informal interactions, which employees with longer work experience especially value.

To ensure effective communication, organizations must regularly monitor and evaluate internal communication practices. Furthermore, this study recommends expanding future research by incorporating qualitative methods, such as structured interviews with stakeholders in hybrid environments. Such approaches would complement the current quantitative findings and provide deeper insights into employee needs and communication dynamics in hybrid models.

This would support the development of more tailored strategies for enhancing productivity and satisfaction in contemporary work structures.

REFERENCES

Choudhury, P., Khanna, T., Makridis, C. A., & Schirmann, K. (2022): ***Is hybrid work the best of both worlds? Evidence from a field experiment*** (Harvard Business School Working Paper No. 22-063). Harvard Business School. https://www.hbs.edu/ris/Publication%20Files/22-063_639195cc-e7b5-47d3-9281-62d192c5b916.pdf (Accessed March 30, 2025)

Ergotron. (2022): ***Hybrid employees prioritize health and wellness more than ever, according to a new Ergotron report***. https://www.ergotron.com/en-au/resources/resource-details/6302 (Accessed March 30, 2025)

European Agency for Safety and Health at Work. (2021): ***Regulating telework in a post-COVID-19 Europe.*** https://data.europa.eu/doi/10.2802/125499 (Accessed March 30, 2025)

Fauville, G., Luo, M., Queiroz, A. C. M., Bailenson, J. N., & Hancock, J. (2021): ***Zoom exhaustion & fatigue scale***. SSRN. https://doi.org/10.2139/ssrn.3786329 (Accessed March 30, 2025)

Griffin, R. W., Phillips, J. M., & Gully, S. M. (2020): ***Organizational behavior: Managing people and organizations*** (13th ed.). Cengage.

Hardt, H. (2008): ***Critical communication studies*** (1st ed.). Routledge.

Iqbal, K. M. J., Khalid, F., & Barykin, S. E. (2021): ***Hybrid workplace: The future of work***. In B. Khan, M. Kuofie, & S. Suman (Eds.), *Handbook of research on future opportunities for technology management education* (pp. 28–48). IGI Global. https://doi.org/10.4018/978-1-7998-8327-2.ch003 (Accessed March 30, 2025)

Lamza-Maronić, M., & Glavaš, J. (2008): ***Poslovno komuniciranje***. Osijek: Ekonomski fakultet u Osijeku.

Microsoft. (2022): ***Great Expectations: Making Hybrid Work Work***. https://www.microsoft.com/en-us/worklab/work-trend-index/great-expectations-making-hybrid-work-work (Accessed March 30, 2025)

Microsoft. (n.d.): ***Što je hibridni rad?*** https://www.microsoft.com/hr-hr/microsoft-teams/hybrid-work-from-home (Accessed March 30, 2025)

Owl Labs. (2022): ***State of remote work 2022.*** https://resources.owllabs.com/hubfs/2022-10_SORW/Owl-Labs-State-of-Remote-Work-2022.pdf (Accessed March 30, 2025)

Prodoscore. (2020): ***Prodoscore research: The productivity of the remote workforce remains strong during the pandemic. Business Wire.*** https://www.businesswire.com/news/home/20201217005250/en/Prodoscore-Research-Productivity-of-Remote-Workforce-Remains-Strong-During-Pandemic (Accessed March 30, 2025)

Shirmohammadi, M., Au, W. C., & Beigi, M. (2022): ***Remote work and work-life balance: Lessons learned from the COVID-19 pandemic***. *Human Resource Development International, 25*(2), 163–181. https://doi.org/10.1080/13678868.2022.2047380 (Accessed March 30, 2025).

Vartiainen, M. A., & Vanharanta, O. (2023): ***Hybrid work: Definition, origins, debates and outlook*** (Working Paper No. WPEF23002). European Foundation for the Improvement of Living and Working Conditions. https://www.eurofound.europa.eu/sites/default/files/wpef23002.pdf (Accessed March 30, 2025).

A scientific paper

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AN ENTREPRENEURIAL ECOSYSTEM PERSPECTIVE ON BARRIERS OF SUSTAINABLE BUSINESS MODEL INNOVATION

ABSTRACT

Sustainable business model innovation is crucial to foster a more sustainable economy. However, such innovations are challenging and prior research on barriers often focuses on ex-post analysis of successful companies and neglects systemic conditions. The article applies an entrepreneurial ecosystem perspective that emphasizes business model innovation as a central outcome of ecosystems. The qualitative study of 46 firms excavates distinct barriers pertaining to different elements of the entrepreneurial ecosystem and shows how they prevent sustainable business model innovation of value propositions, value creation, and value capture. The article contributes to research on the barriers of sustainability transformation and business model innovation and to studies on the relation between entrepreneurial ecosystem elements and business model innovation.

***Key words**: Sustainability, Business Model Innovation, Entrepreneurial Ecosystem, Transformation.*

1. Introduction

As the consequences of irresponsible and environmentally harmful economic activities become increasingly visible and tangible, the urgency for adopting more sustainable practices is gaining growing attention in both research and practice (Audretsch and Fiedler, 2024; Gregori *et al.*, 2025; Sarasvathy and Ramesh, 2019). However, to achieve sustainability, the economy needs to undergo fundamental transformations, especially companies with intensive emissions of greenhouse gases (GHG). Business model innovations as the foundation for a more wide-ranging sustainable transformation are direly needed (Evans *et al.*, 2017; Geissdoerfer *et al.*, 2018; Klein *et al.*, 2021). Yet, one essential and still unresolved question remains: What

prevents many existing—often long-established—firms from transforming their business models to make them more sustainable?

Sustainable business model innovation has emerged as a topic of increasing relevance in research. These innovations are challenging, and prior work has identified several critical barriers such as scarce financial resources, the organizational culture, or lack of appropriate tools (Evans *et al.*, 2017; Schwarz *et al.*, 2021). Interestingly, existing studies on this topic mostly focus on ex-post analysis of companies that successfully transformed their businesses (Caldera *et al.*, 2019; Roome and Louche, 2016; Vermunt *et al.*, 2019). As a result, companies that have not yet engaged in or even considered sustainable innovation are often overlooked in academic inquiry (Urbinati *et al.*, 2021).

In addition, prior work often neglects the systematic conditions that affect business model innovation. While several studies distinguish between company internal and external factors, these external aspects are dominantly concerned with the governmental regulations, supply chain management, or regional culture (Cederholm Björklund, 2018; Hina *et al.*, 2022; Vermunt *et al.*, 2019). This narrow focus potentially neglects other important factors. Collective efforts from various economic actors are necessary for a successful transformation. Hence, research increasingly calls for ecosystem perspectives as they offer a systematic engagement with a wide range of interrelated aspects affecting transformation (Acs *et al.*, 2017; Gregori et al., 2025; Volkmann *et al.*, 2021). Furthermore, we lack insights on how ecosystems and business model innovation for sustainability relate (Madsen, 2020). Based on this, we ask: *"How do shortcomings of entrepreneurial ecosystems hinder sustainable business model innovation."*

This study applies a business model perspective, whereas business models are defined as three interlocked components, namely value proposition, value creation, and value capture, of a focal firm (Bocken *et al.*, 2014; Gregori *et al.*, 2024; Schwarz *et al.*, 2021). We build on entrepreneurial ecosystems literature that emphasize business model innovation as a central desired outcome of ecosystems (Ritala and Thomas, 2025; Wurth *et al.*, 2022) and consider entrepreneurial ecosystems as multiple connected actors at a specific scale with a shared goal (Acs *et al.*, 2017; Audretsch *et al.*, 2022; Gregori *et al.*, 2025; Isenberg, 2016). The study follows a qualitative approach. We conducted a single-case study that included interviews with 46 GHG-intensive firms in a regional ecosystem.

Our findings reveal distinct barriers pertaining to different elements of the entrepreneurial ecosystem and we analyze how these barriers prevent sustainable business model innovation of value propositions, value creation, and value capture. We contribute to 1) research on the barriers of sustainability transformation and business model innovation (Evans *et al.*, 2017; Hina *et al.*, 2022; Urbinati *et al.*, 2021; Vermunt *et al.*, 2019) and 2) research on the relation between entrepreneurial ecosystem elements and business model innovation (Autio *et al.*, 2018; Madsen, 2020; Wurth *et al.*, 2022). The article further presents practical implications, limitations, and future research directions.

2. Theoretical framework

2.1. Sustainable businesses model innovation

Business models became a central concept for researching and understanding business transformations toward sustainability (Geissdoerfer *et al.*, 2018). The business model refers to

the logic of how a company conducts business activities (Chesbrough and Rosenbloom, 2002; Richardson, 2008). It describes the interdependent components of a company and their interactions, portraying how an organization functions, and what goals it seeks to achieve (Geissdoerfer *et al.*, 2018; Massa *et al.*, 2017).

Business models consist of several components that evolve around the concept of value. The interest in sustainability extended the notion of value to include social and ecological dimensions in addition to economic forms such as financial gain (Bocken *et al.*, 2014; Gregori *et al.*, 2024). Typically, three core components make up a business model. First, the value proposition that refers to the value that is offered by the company through the products and services. Initial business model research was mainly interested in customer-centric offerings, and thus, the unique selling proposition or the job to be done for a specific target group (Osterwalder *et al.*, 2005). Sustainable business models draw attention to environmental and social value that do not necessarily benefit the customers directly but are aimed at a wider array of stakeholders (Schaltegger *et al.*, 2016; Schwarz *et al.*, 2021). For instance, this may include the proposition of reducing waste, noise, or CO2 emissions. Second, value creation entails the sum of key activities and resources necessary to produce and deliver the proposed value to the envisioned beneficiaries (Richardson, 2008). From a sustainability perspective, this component needs to systematically consider the stakeholder interests of all actors involved in the value creation process. Third, the value capture component refers to the activities that account for the produced value. These activities include accounting for the company's financial gains and losses (Chesbrough and Rosenbloom, 2002). However, sustainable business models also raise the question of how companies account for environmental and social impact (Schwarz *et al.*, 2021).

Business model innovations are crucial for improving environmental, social, and economic performance (Evans *et al.*, 2017). Business model innovations can be defined as designing and implementing "nontrivial changes to the key elements of a firm's BM [business model] and/or the architecture linking these elements" (Foss and Saebi, 2017, p. 216). Building on this, sustainable business model innovation can be considered as the transformation from one state of a business model to another or the development of a completely new business model that incorporates the necessary multi-stakeholder view, the creation of noneconomic and economic value for all stakeholders and taking a long-term perspective.

2.2. Entrepreneurial ecosystems

The ecosystems lens is increasingly used to analyze economic action in a specific region because it offers a framework to consider systemic conditions of economic phenomena (Thomas and Autio, 2020). In the most general form, ecosystems refer to a collective of actors that are interdependent and produce a desired outcome (Thomas and Ritala, 2022). This study is interested in business model innovation as a central outcome of a regional ecosystem. Hence, we build on entrepreneurial ecosystem literature since their focus on entrepreneurial activities and business model innovation makes them distinct from other approaches (Autio *et al.*, 2018; Ritala and Thomas, 2025; Wurth *et al.*, 2022). Thereby, entrepreneurial activity is considered as innovative, pro-active, and risk-taking inclinations aiming at social change that are not confined to new venture creation (Gregori and Holzmann, 2022; Hietschold *et al.*, 2022). As environmental (and related societal) challenges increase worldwide, researchers call to investigate how ecosystems need to be configured to support sustainable transitions (Volkmann *et al.*, 2021). For example, research explored the role of sustainability orientation of

entrepreneurial ecosystem actors and how it relates to the quality of institutions in a region (Audretsch *et al.*, 2024).

Different frameworks emerged for studying entrepreneurial ecosystems. However, we can observe a form of consolidation since entrepreneurial ecosystems converge towards a componential approach (Isenberg, 2011; Stam and van de Ven, 2021). Entrepreneurial ecosystems are considered to consist of different distinct elements that interact resulting in the desired outcome. Despite the absence of a generally agreed framework, we draw upon the six elements of entrepreneurial ecosystems that presents a widely adopted and influential concept in research and practice (Audretsch *et al.*, 2022; Isenberg, 2011).

This approach includes *policy,* referring to the formal institutions in a given geographical area including the prevailing legal framework or long-term political agendas. (Audretsch *et al.*, 2022). The *finance* pillar entails various financial resources, including venture capital, traditional bank loans, crowdfunding, philanthropy or private savings (Stam and van de Ven, 2021). Furthermore, qualified *human capital* is crucial for entrepreneurial and innovative activity and this element is concerned with the relevant skills of individuals but also educational institutions or training programs fostering human capital (Audretsch *et al.*, 2022). Every innovation must satisfy *market* demand, and thus, supply and demand are crucial aspects of every entrepreneurial ecosystem (Sussan and Acs, 2017). For physical products, distribution networks and logistics are also an aspect usually associated with the market element (Isenberg, 2010). *Culture* is another crucial element referring to values, beliefs, and norms related to entrepreneurial activity. For example, culture includes tolerance of failure and risk acceptance or the status of innovative companies and entrepreneurs (Donaldson, 2021). Moreover, *support* factors such as basic infrastructure, power grids, internet, or transportation are crucial. Yet, this also entails support organizations like business incubators (Isenberg, 2011).

2.3. The intersection of entrepreneurial ecosystems and sustainable business model innovation

While there is growing scholarly interest in the intersection of entrepreneurial ecosystems and business model innovation (Autio *et al.*, 2018; Ritala and Thomas, 2025; Wurth *et al.*, 2022), empirical insights in the context of sustainability remain limited. Prior work has argued that entrepreneurial ecosystems are needed to support sustainable business models in a region through the access of crucial success factors such as resources or social networks (Lit et al., 2024; Neumeyer and Santos, 2018). Due to the increased need for ventures to cooperate with a wide range of stakeholders in the context of sustainability, an ecosystem perspective is a more appropriate conceptual tool to analyze sustainable business model innovation (Kanda et al., 2021). A recent review has shown that institutional support programs, culture, digital technologies, and access to resources are prerequisites to further business model innovation and thus a sustainability transition (Chaudhury et al., 2023).

However, aiming for a sustainable venture can also be a liability associated with many challenges. Other ecosystem actors might lack familiarity with sustainable business models, making it more difficult for sustainable ventures to acquire resources from such actors (Neumeyer and Santos, 2018). Hence, innovating towards more sustainable business models entails additional barriers including poor credibility, constrained resources, and insufficient institutions in the respective ecosystem (Li et al., 2024). Bauwens et al. (2024) suggest that system-building activities are important to circumvent such barriers and to foster collective benefits, but this cannot be achieved alone. Instead, networks and associations are needed to

encourage resource sharing and enable the local entrepreneurial ecosystem. It is still a central question how the ecosystemic conditions and cooperation between several ecosystem actors shape or prevent sustainable business model innovation (Ferreira et al., 2024).

3. Method

3.1. Research context

This study aims at conducting an analysis of companies in need of transformation. To identify such companies, we aimed for a region that is heavily affected by the objectives of the European Green Deal due to its existing industrial structure. The Green Deal aims to make the European Union a climate-neutral continent by 2050, which provided a suitable starting point for this study (European Commission, 2019). Specifically, we chose a region supported by the Just Transition Fund (JTF) for the study because the JTF only supports regions severely affected by the transition to a climate-neutral economy (European Commission, 2022). These are often former mining regions with a high proportion of heavy industry, including steel, cement, and chemical production. Such industries are responsible for high CO2 emissions and are therefore obliged to decarbonize production processes and thus to innovate their business models.

3.2. Data collection

To identify relevant businesses in the region, the business register from the regional chamber of commerce was screened. We created a shortlist of relevant and suitable companies based on the criteria of the JTF of the most GHG intensive industries. The inclusion criteria entailed firms in (1) industrial production and associated service, (2) operating locally in the region, and (3) active operations.

Following this procedure, 158 companies were identified and classified according to their primary industry. All companies were contacted personally via phone and received follow-up information with an interview invitation. 46 companies agreed to participate in the study. That is 29.1% of the total population. The distribution of the analyzed companies in terms of size and industry is mainly consistent with the composition of the overall population. The companies can be categorized into small medium-sized enterprises (SMEs, less or equal 250 employees) and large enterprises (LEs, more than 250 employees). We conducted semi-structured interviews with knowledgeable members of the organizations (Gioia *et al.*, 2013) between November 2021 and March 2022. The interview was conducted with the top management (e.g., business director or business owner) or other representatives with deep insights into the company. See Table 1 for an overview of the industries of the sampled companies, the number of interviews and their size.

Table 1: Overview of interview partners, their industry and company size; small and medium enterprises (SME): less or equal 250 employees; large enterprises (LE): more than 250 employees

Industry	# of interviews	Size of companies based on number of employees	Abbr.
Mechanical engineering, metal products, electrical systems, iron and steel production, manufacture of tubes foundries, vehicle construction, motor vehicles and motor vehicle parts, non-ferrous metals	27	18 SME 9 LE	M 1-27
Wood processing, paper and paperboard, printed products others (e.g., furniture)	9	6 SME 3 LE	W 1-9
Glass and glassware, ceramics, stone and pottery processing	7	5 SME 2 LE	G 1-7
Chemistry, petrochemistry and pharmacy	3	1 SME 2 LE	C 1-3
Total	**46**	**30 SME** **16 LE**	

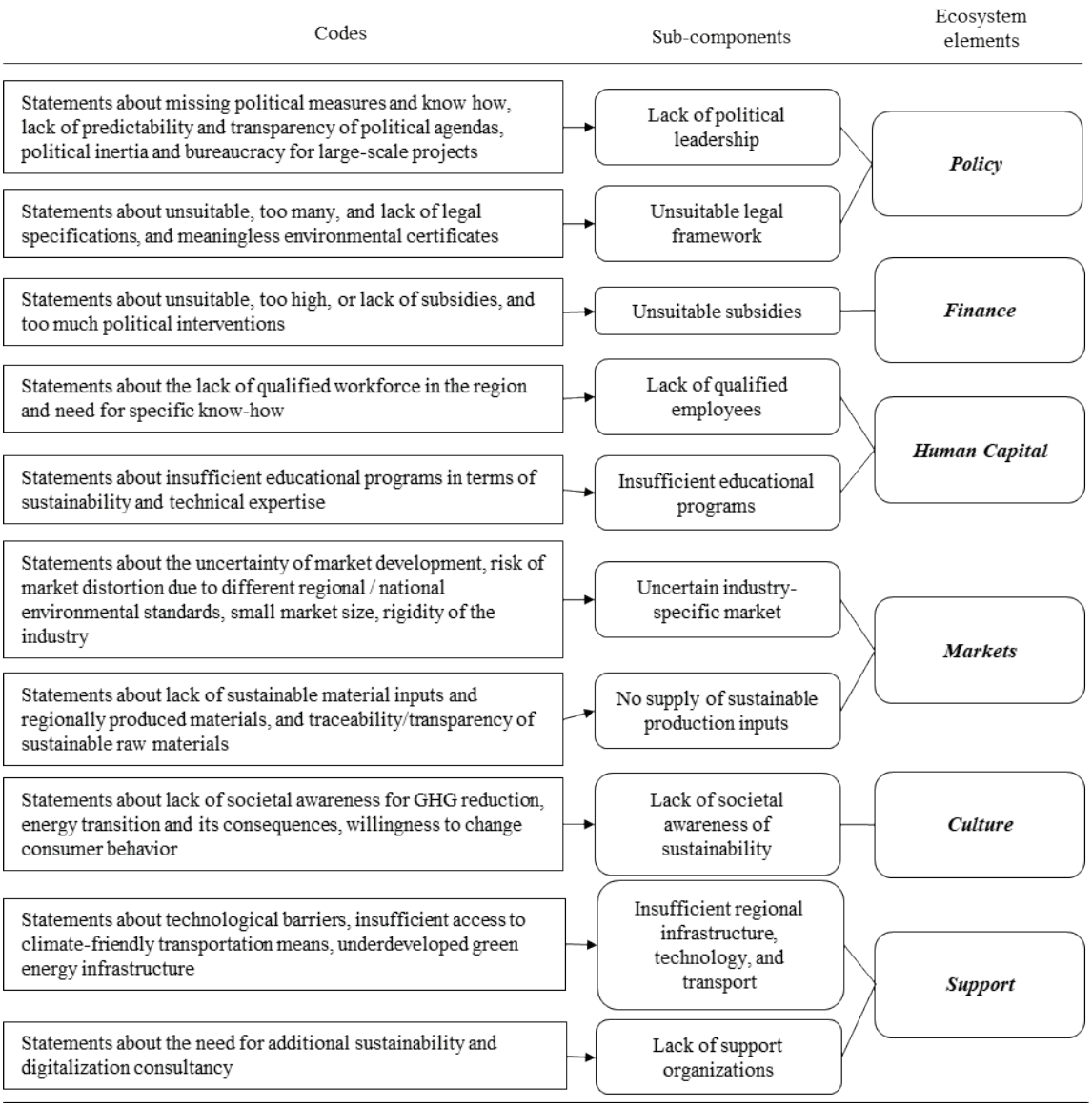
Source: Authors

In addition, we collected secondary data including homepages, sustainability reports, and press releases that were screened before the interviews. These proved valuable in better understanding the context of the companies and sustainability measures the interview partners referred to. One average the interviews lasted approximately one hour (min: 35min; max: 95 min). All interviews were recorded and transcribed.

3.3. Data analysis

The empirical study followed recommendations for category development based on thematic analysis (Braun and Clarke, 2013). In a first step, we coded different barriers close to the information provided by our interviewees. This resulted in an extensive list of codes based on excerpts from the raw data. Subsequently, we compared these codes with one another to further summarize similar statements. We then used elements of entrepreneurial ecosystems (e.g., finance, market, policy) to organize the developed codes. Subsequently, we categorized the codes into sub-components of each of the ecosystem elements. For instance, we used the ecosystem element “policy” as a sensitizing frame for deriving different sub-components (e.g., political leadership and legal framework) that we used to aggregate the codes. Figure 1 provides an overview of the data structure.

Figure 1: Data Structure



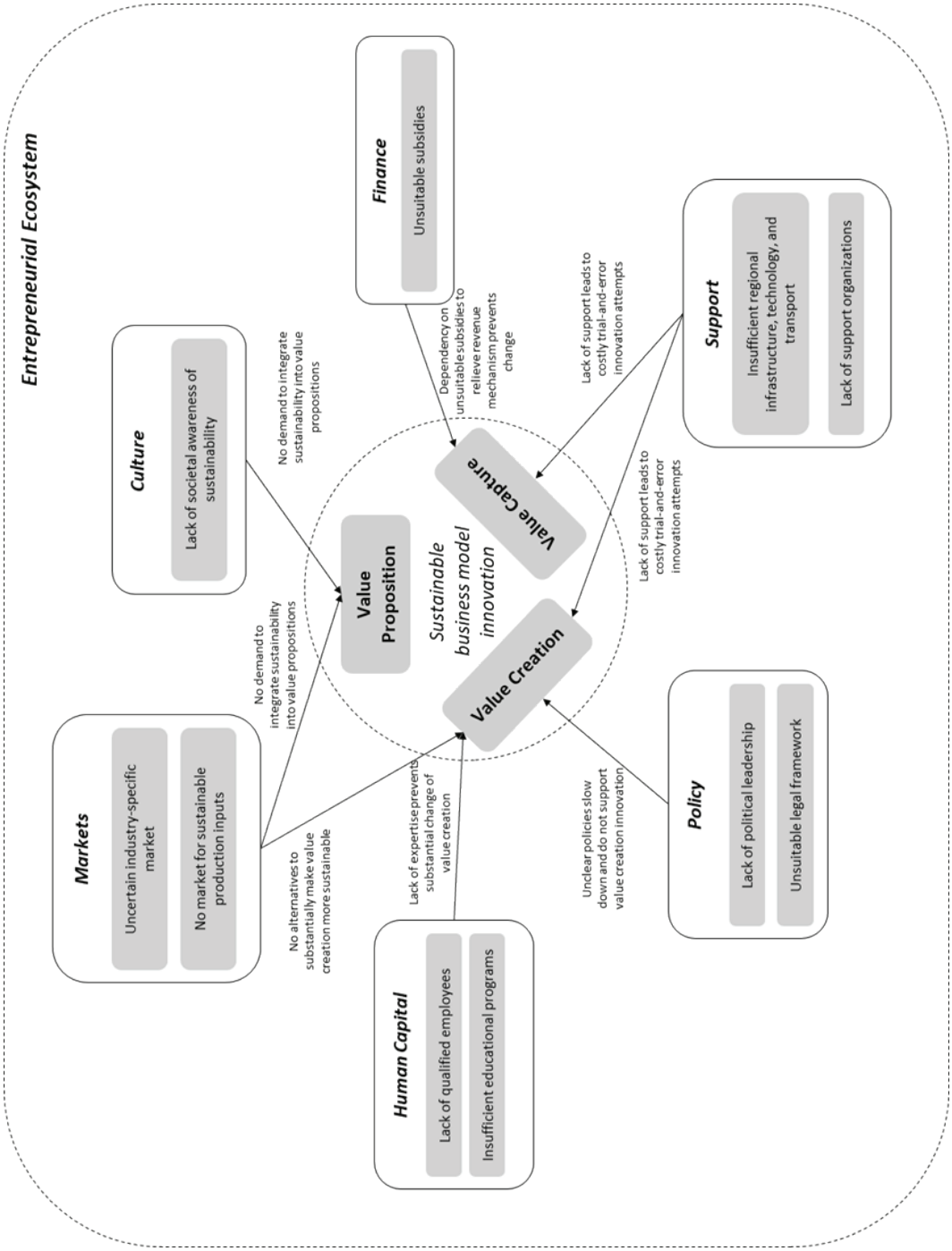
Source: Authors

In the next step, we related the entrepreneurial ecosystem elements to the three business model components: value proposition, value creation, and value capture. We did this to portray how the different aspects of the entrepreneurial ecosystem potentially hinder a substantial change in the business model components.

4. Findings

We identified several perceived barriers on an entrepreneurial ecosystem level that affect companies in their efforts to innovate their business model towards more sustainable states. Figure 2 provides an overview of how the entrepreneurial ecosystem elements and the perceived shortcomings prevent substantial changes to business models. In the following, we describe these findings in detail.

Figure 2: Schematic summary of how different entrepreneurial ecosystem shortcomings prevent sustainable business model innovation



Source: Authors

Regarding regional *policy,* informants pointed towards a lack of political leadership to support the necessary changes, which predominantly concerns the value creation dimension. For example, M5sme stated that "*it is necessary, that [the regional government] takes a clear standpoint"*. Findings point out the lack of political measures and know-how at various levels. One interviewee, for instance, described that his company took part in a sustainability program and "*implemented measures, while the responsible public administration office was not even aware that these measures are necessary"* (W9sme). The unpredictability of political development on a national and international level was also mentioned resulting in uncertainty and non-transparency about how the situation for the individual businesses will develop (e.g., M10sme).

The informants perceived the legal framework very differently. Some argue that the legal specifications are not suitable for supporting sustainability (e.g., C1le). Others criticize that there are too many legal specifications (e.g., G1sme, M4le, M22le) such as in the case of C2sme that experiences the pressure of the "watchful eye of the authorities" in the chemical industry. Challenging authorization and long permission processes (e.g., construction permits) were also mentioned in this regard. For instance, an informant reported that their company was waiting over a year for permits to install photovoltaic to make their value creation more sustainable (e.g., M3sme). Another group of interviewees argued that there are not enough legal specifications to enforce positive changes (e.g., M11sme, M13sme, W6sme). An informant stated that the transition towards sustainability is a *"question where I haven't given much attention yet, and I haven't had the time and […] not the pressure to do it at all."* As such, he doesn't feel the need to change anything. On a similar note, the companies argued that the politically enforced environmental certifications are meaningless because such a system is more likely to lead to fraud than to real change in companies (e.g., G4sme, W9sme).

One of the most discussed aspects was *finance*. However, financial support for sustainable business model innovation was mainly related to government financing, and thus, subsidy policy. Hence, similar to the legal framework, there were again different opinions concerning the arrangement of financial support and related policies. While some companies argued that subsidies are too high resulting in too much political intervention in several aspects of business development (e.g., M11sme), others lamented a lack of subsidies for their specific needs pointing out that the budget is quickly exhausted. Producing greener energy to improve value creation was again mentioned as an example by informants (e.g., M12sme, M4le). Others also referred to the lack of financial resources to support digitalization of logistics (e.g., G1sme). Generally, the guidelines for getting subsidies are often considered unsuitable (e.g., M10le). However, to overcome financial barriers informants emphasized the dependency on subsidies to relieve their revenue mechanism. Yet, applying for and processing such subsidies is costly as well (e.g., G1sme).

Moreover, interviewees criticized the available *human capital* in the region, which affected their value creation activities. In a large part of the interviews, it became evident that a lack of qualified employees and workforce within the region that has the necessary knowledge for sustainability transformation presents a major barrier (e.g., M1sme, M2sme, W2sme, M24sme). It is also difficult to get these individuals from other parts of the country or from abroad because the region is perceived as not very attractive compared to others (e.g., W2sme, M1sme, M9sme, G3sme). In addition, there is a lack of suitable regional educational institutions that might be able to circumvent the human capital problem. For example, M13sme explained that the region lacks education about sustainability topics such as recycling, which also entails technical

expertise. In addition, additional key partners that offer core technologies would be direly needed (e.g., M2sme, G6le).

Concerning *markets*, informants point out several crucial challenges. These challenges prevent them from changing their value creation such as leveraging more sustainable production inputs, which also affects their value proposition. In general, companies perceived the market development of their industries as uncertain (e.g., M15le, G6le). They further highlighted the fear of local market distortion, mentioning that firms from other regions with different legal systems can offer cheaper products since they do not have to adhere to the same environmental regulations (e.g., C3le, G3sme, G6le, M7sme, M10le). Moreover, the market for sustainable production inputs is problematic for many of the interviewed companies, as they are lacking access to sustainable production inputs. In the case of the analyzed ecosystem this becomes especially apparent for three raw materials: cement (e.g., G4sme, G5sme, G6le), steel (e.g., M1sme, M5sme, M20sme) and plastic (e.g., M2sme, M25le). In addition, there are no substitutes for these raw materials (e.g., G5sme). Mostly, regional or European producers of more sustainable production inputs are non-existent (C1le, G3sme, M5sme, M6le, M7sme, W6sme). The lack of alternatives increases companies' dependency on available key partners, for instance, in transportation (e.g., G1sme, W9sme) or specific material suppliers (e.g., M4le, M10le, G5sme, W9sme), which in turn decreases the possibility for innovating the value creation. Even if substitutes are possible, this would result in a fundamental change in the composition of the material and ultimately to worse quality (e.g., C1le). Hence, changing the product to be more sustainable would lead to a diminished value proposition concerning other values such as quality and convenience.

Regarding *culture,* societal awareness of sustainability was the core barrier to innovating value propositions. The mentioned aspects are closely related to the demand side of the regional market. Informants referred to the lack of awareness concerning the need to reduce GHG (e.g., G7le, C1le) and concerning the energy transition and its consequences (e.g., C3le). For instance, C3le states that people don't know what such changes would mean for how we live and work together. Similarly, the companies also recognized society's unwillingness to change their consumption behavior (e.g., G7le). Hence, the informants argued that this hinders changes of their value propositions because there is no customer need for sustainable products. For instance, they mentioned the lack of demand for products with reduced CO2 emissions (e.g., C1le, G4sme, M1sme, M22le). In some cases, the customers implicitly demand unsustainable products as they often voice wishes for product specifications that lead to more waste, unrecyclable material, or emissions (e.g., W2sme). The interviewees further emphasized this point by arguing that regional culture is slow in changing its values in this regard (e.g., M19sme).

The *support* dimension highlights challenges concerning technology, transport, infrastructure, and support organizations. Some companies pointed towards technological barriers that hinder them from implementing sustainable solutions and changing their value creation. Many urgently needed technologies are still in the launch or even testing stage and not ready for industrial use (G7le). W6sme argues that they have been aiming to replace diesel generator with green alternatives for a long time, but this is illusory for their purposes. Companies argue that sustainable technology is not yet mature (e.g., M12sme, W1sme). Another issue is the insufficient climate-friendly transportation infrastructure in the region (M13sme). Thus, transportation becomes a cost factor, where paying for sustainable alternatives is considered nearly impossible (e.g., G1sme). Informants also criticized the underdeveloped infrastructure for green energy (e.g., G7le) and were concerned about the rising demand for green energy that

cannot be provided (C3le, G3sme, G6le, G7le, W3le). Relatedly, the costs of green energy and electricity are considered too high and, together with transportation expenses, negatively affect value capture (e.g., M4le, M17sme). Moreover, the region needs additional support organizations such as consultancies that provide expert knowledge for sustainable business model innovation to circumvent costly and often unsuccessful trial-and-error processes (e.g., M4le, M15le, M18le, M25le).

5. Discussion

5.1. Theoretical implications

Our findings offer two contributions. First, we contribute to research on the barriers of sustainability transformation and business model innovation (Evans *et al.*, 2017; Hina *et al.*, 2022; Urbinati *et al.*, 2021; Vermunt *et al.*, 2019). Second, we offer an improved understanding of how entrepreneurial ecosystem elements affect business model innovation (Autio *et al.*, 2018; Madsen, 2020; Wurth *et al.*, 2022).

Our framework provides a meaningful extensions of prior findings that addressed the internal and external barriers of firms in the context of sustainable business model innovation (e.g., Cederholm Björklund, 2018; Evans et al., 2017; Hina et al., 2022). By leveraging an entrepreneurial ecosystems approach, our study foregrounds aspects that have thus far received limited scholarly attention, such as infrastructure related to green energy and regional transportation systems (Hina *et al.*, 2022). For many of our informants, sustainability is primarily perceived as a cost factor. While this is not surprising per se, the lack of business cases for sustainability that create multiple forms of value without compromising financial success (Gregori and Holzmann, 2020; Schaltegger *et al.*, 2019) is problematic. This finding points to the urgent need for altered systemic conditions that can better support sustainable business model innovation.

Many of the identified barriers – particularly those related to policy, finance, culture, and support – imply regional inertia. For instance, according to the informants, societal awareness of regional customers is a crucial challenge in innovating value propositions, and that this situation is unlikely to improve in the near future. Similarly, bureaucratic delays in obtaining permits for sustainable energy solutions were cited as a significant challenge. We argue that such challenges provide a starting point where entrepreneurship research can contribute to the discussion of sustainable transitions. Instead of framing ecosystems as supportive contexts, we should be more interested in how we can produce ecosystems that are entrepreneurial actors in their own right – capable of collectively establishing values and facilitating sustainability transformations (Gregori *et al.*, 2025). Achieving this, however, requires the involvement of not only firms and entrepreneurs, but also proactive, innovative, and risk-taking policy makers, educational institutions, civil society actors, financial intermediaries, and support organizations.

Recent research has highlighted the importance of exploring the link between entrepreneurial ecosystems and business model innovation (Ritala and Thomas, 2025; Wurth *et al.*, 2022). In addition, it has argued for the importance of investigating the microfoundations of entrepreneurial ecosystem, that is, how individual actors engage with the ecosystem they are embedded in (Wurth *et al.*, 2022). By exploring a wide range of firms and relating their perception of ecosystem barriers to business model components, we identify novel challenges that result from the systemic conditions of the ecosystem. For instance, we find that the

configuration of policy subsidies and the availability of regional collaboration partners creates dependencies that hinder substantial innovation in firms' value creation activities.

Another crucial insight emerging from our data is the heterogeneity in the interpretation of ecosystem elements such as in the area of finance and public policy. Our findings show that companies hold divergent perceptions concerning, for example, the availability and utility of policy subsidies and the degree of political intervention. It remains unclear whether these differences stem from a lack of information about systemic conditions or if firms engage with different elements of the ecosystem. Regardless of their origin, these perceptions are highly consequential, as they shape firms' willingness and capacity to engage in sustainable business model innovation. Thus, ecosystem research is well advised to investigate the roots of such perceptual divergence more systematically.

Furthermore, sustainability transitions demand system-level solutions that include a wide array of stakeholders (George *et al.*, 2024; Sarasvathy and Ramesh, 2019). Our findings align with this assertion but also highlight the problem of responsibility attribution. The informants reported to feel constrained in their possibilities and aspirations because of conditions external to the firm. Many of them further argued that they do not have direct control over the ecosystem configuration, such as in the case of a lack of societal awareness, insufficient educational programs, insufficient regional infrastructure, or a lack of support organizations. At the same time, this raises important questions about who is responsible for changing and adapting these ecosystem elements. Addressing this issue constitutes a critical avenue for future research.

5.2. Practical implications

Our findings also offer valuable practical implications for firms and policymakers. With the JFT and its 17 billion Euro budget, the European Commission is charting a course for sustainable transformation at the supranational level. However, such supranational initiatives must not overlook the importance of regional perspectives (European Commission, n.d.), which need to be meaningfully integrated into the superordinate measures. In this regard, our framework provides policymakers with a tool for analyzing regional conditions and their connection to sustainable business model innovation.

In conjunction with existing literature, the ecosystem-related barriers identified in this study offer actionable insights for practitioners aiming to develop and transform both businesses and ecosystems. Understanding these barriers and pitfalls is critical for devising effective solutions, building productive networks, and fostering support among the various actors within the ecosystem.

Furthermore, the present study highlights the need for intermediary organizations that connects ecosystem actors by sharing knowledge and fostering and improving collaboration (Goswami *et al.*, 2018). Challenges such as confusing policy landscapes, lack of know-how, consulting, and similar aspects, can be tackled by such an intermediary organization. Intermediaries aim to create networks between companies and their stakeholders, politics and public administration, universities and research centres, and society and media. Once these networks are established, through exchange between and cooperation among these actors, many of the identified barriers can be mitigated. Our framework can offer a starting point to create intermediary organizations that are tailored to the needs of the respective region.

6. Limitations and future research

This study is subject to several limitations, which at the same time offer promising directions for future research. Although we contacted all eligible regional companies, a substantial number chose not to participate. Consequently, our findings may be affected by a self-selection bias, as participating firms may have been more interested or engaged in sustainability issues than those who declined. Companies that did not take part in the study might experience distinct barriers or hold alternative perceptions of the regional entrepreneurial ecosystem, which could yield additional insights.

Moreover, our study focuses on sustainable business model innovation at the level of individual firms. While this perspective is central, entrepreneurial ecosystems are inherently multi-actor systems that include not only firms, but also policy makers, educational institutions, support organizations, and civil society actors. Future research should therefore seek to broaden the empirical base by incorporating a more diverse set of stakeholder perspectives. Although such a task is methodologically demanding, it may be supported using archival data, policy documents, or network analyses to complement qualitative interviews.

Finally, our work highlights the different perceptions of ecosystem actors and raises questions of responsibility for transforming business and, thus, the region. Investigating different responsibilities in entrepreneurial ecosystems is an important research direction that can provide new insights into the necessary transformation toward sustainability.

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Conflict of interest statement
There is no conflict of interest.

REFERENCES

Acs, Z.J., Stam, E., Audretsch, D.B. and O'Connor, A. (2017): ***The lineages of the entrepreneurial ecosystem approach, Small Business Economics***, Vol. 49 No. 1, pp. 1–10, doi: 10.1007/s11187-017-9864-8.

Audretsch, D.B., Belitski, M., Eichler, G.M. and Schwarz, E. (2024): ***Entrepreneurial ecosystems, institutional quality, and the unexpected role of the sustainability orientation of entrepreneurs***, Small Business Economics, Vol. 62 No. 2, pp. 503–522, doi: 10.1007/s11187-023-00763-5.

Audretsch, D.B., Eichler, G.M. and Schwarz, E.J. (2022): ***Emerging needs of social innovators and social innovation ecosystems***, International Entrepreneurship and Management Journal, Vol. 18 No. 1, pp. 217–254, doi: 10.1007/s11365-021-00789-9.

Audretsch, D.B. and Fiedler, A. (2024): ***Bringing the knowledge spillover theory of entrepreneurship to circular economies: Knowledge and values in entrepreneurial ecosystems***, International Small Business Journal: Researching Entrepreneurship, Vol. 42 No. 4, pp. 480–505, doi: 10.1177/02662426231218357.

Autio, E., Nambisan, S., Thomas, L.D.W. and Wright, M. (2018): ***Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems***, Strategic Entrepreneurship Journal, Vol. 12 No. 1, pp. 72–95, doi: 10.1002/sej.1266.

Bauwens, T., Hartley, K., Hekkert, M. and Kirchherr, J. (2024): ***Building innovation ecosystems for circularity: Start-up business models in the food and construction sectors in the Netherlands***, Journal of Cleaner Production, Vol. 481, p. 143970, doi: 10.1016/j.jclepro.2024.143970.

Bocken, N.M.P., Short, S.W., Rana, P. and Evans, S. (2014): ***A literature and practice review to develop sustainable business model archetypes***, Journal of Cleaner Production, Vol. 65, pp. 42–56, doi: 10.1016/j.jclepro.2013.11.039.

Braun, V. and Clarke, V. (2013): ***Successful Qualitative Research: A Practical Guide for Beginners***, SAGE, London.

Caldera, H.T.S., Desha, C. and Dawes, L. (2019): ***Evaluating the enablers and barriers for successful implementation of sustainable business practice in 'lean' SMEs***, Journal of Cleaner Production, Vol. 218, pp. 575–590, doi: 10.1016/j.jclepro.2019.01.239.

Cederholm Björklund, J. (2018): ***Barriers to Sustainable Business Model Innovation in Swedish Agriculture, Journal of Entrepreneurship***, Management and Innovation, Vol. 14 No. 1, pp. 65–90, doi: 10.7341/20181414.

Chaudhary, S., Kaur, P., Alofaysan, H., Halberstadt, J. and Dhir, A. (2023): ***Connecting the dots? Entrepreneurial ecosystems and sustainable entrepreneurship as pathways to sustainability***, Business Strategy and the Environment, Vol. 32, No. 8, pp. 5935–5951, doi: 10.1002/bse.3466.

Chesbrough, H.W. and Rosenbloom, R.S. (2002): ***The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies***, Industrial and Corporate Change, Vol. 11 No. 3, pp. 529–555, doi: 10.1093/icc/11.3.529.

Donaldson, C. (2021): ***Culture in the entrepreneurial ecosystem: a conceptual framing***, International Entrepreneurship and Management Journal, Vol. 17 No. 1, pp. 289–319, doi: 10.1007/s11365-020-00692-9.

European Commission. (2019): ***The European Green Deal***. available at: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en (accessed 4 March 2025)

European Commission. (2022): ***EU Cohesion Policy: €76 million for a just climate transition in Austria***, available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_22_4862 (accessed 4 March 2025).

European Commission. (n.d): **Just Transition Funding Sources**. available at: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism/just-transition-funding-sources_en (accessed 12 March 2025)

Evans, S., Vladimirova, D., Holgado, M., Van Fossen, K., Yang, M., Silva, E.A. and Barlow, C.Y. (2017): ***Business Model Innovation for Sustainability: Towards a Unified Perspective for Creation of Sustainable Business Model***s, Business Strategy and the Environment, Vol. 26 No. 5, pp. 597–608, doi: 10.1002/bse.1939.

Ferreira, J.J., C Fernandes, A.J. and Ramírez-Pasillas, M. (2024): ***Start-ups and entrepreneurial ecosystems in the circular economy: A multi-level approach for safe and just planetary boundaries***, International Small Business Journal: Researching Entrepreneurship, Vol. 42 No. 4, pp. 416–445, doi: 10.1177/02662426231210765.

Foss, N.J. and Saebi, T. (2017): ***Fifteen Years of Research on Business Model Innovation***, Journal of Management, Vol. 43 No. 1, pp. 200–227, doi: 10.1177/0149206316675927.

Geissdoerfer, M., Vladimirova, D. and Evans, S. (2018): ***Sustainable business model innovation***: A review, Journal of Cleaner Production, Vol. 198, pp. 401–416, doi: 10.1016/j.jclepro.2018.06.240.

George, G., Fewer, T.J., Lazzarini, S., McGahan, A.M. and Puranam, P. (2024): ***Partnering for Grand Challenges: A Review of Organizational Design Considerations in Public–Private Collaborations***, Journal of Management, Vol. 50 No. 1, pp. 10–40, doi: 10.1177/01492063221148992.

Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013): ***Seeking Qualitative Rigor in Inductive Research***, Organizational Research Methods, Vol. 16 No. 1, pp. 15–31, doi: 10.1177/1094428112452151.

Goswami, K., Mitchell, J.R. and Bhagavatula, S. (2018): ***Accelerator expertise: Understanding the intermediary role of accelerators in the development of the Bangalore entrepreneurial ecosystem***, Strategic Entrepreneurship Journal, Vol. 12 No. 1, pp. 117–150, doi: 10.1002/sej.1281.

Gregori, P. and Holzmann, P. (2020): ***Digital sustainable entrepreneurship: A business model perspective on embedding digital technologies for social and environmental value creation***, Journal of Cleaner Production, p. 122817, doi: 10.1016/j.jclepro.2020.122817.

Gregori, P. and Holzmann, P. (2022): ***Entrepreneurial practices and the constitution of environmental value for sustainability***, Business Strategy and the Environment, Vol. 31 No. 7, pp. 3302–3317, doi: 10.1002/bse.3077.

Gregori, P., Holzmann, P. and Audretsch, D.B. (2024): ***Sustainable entrepreneurship on digital platforms and the enactment of digital connectivity through business models***, Business Strategy and the Environment, Vol. 33 No. 2, pp. 1173–1190, doi: 10.1002/bse.3551.

Gregori, P., Schwarz, E.J. and Holzmann, P. (2025): ***Agencing entrepreneurial ecosystems for sustainability: A systematic review to rethink values, transformation, and boundaries***, Small Business Economics, pp. 1–51.

Hietschold, N., Voegtlin, C., Scherer, A.G. and Gehman, J. (2022): ***Pathways to social value and social change: An integrative review of the social entrepreneurship literature***, International Journal of Management Reviews, p. ijmr.12321, doi: 10.1111/ijmr.12321.

Hina, M., Chauhan, C., Kaur, P., Kraus, S. and Dhir, A. (2022): ***Drivers and barriers of circular economy business models: Where we are now, and where we are heading***, Journal of Cleaner Production, Vol. 333, p. 130049, doi: 10.1016/j.jclepro.2021.130049.

Isenberg, D.J. (2010): ***How to Start an Entrepreneurial Revolution***, Harvard Business Review, No. 88, pp. 41–49.

Isenberg, D.J. (2011): ***The Entrepreneurship Ecosystem Strategy as a New Paradigm for Economic Policy: Principles for Cultivating Entrepreneurship***, Presentation at the Institute of International and European Affairs, Dublin, Ireland, May 12.

Isenberg, D.J. (2016): ***Applying the Ecosystem Metaphor to Entrepreneurship***, The Antitrust Bulletin, Vol. 61 No. 4, pp. 564–573, doi: 10.1177/0003603X16676162.

Kanda, W., Geissdoerfer, M. and Hjelm, O. (2021): ***From circular business models to circular business ecosystems, Business Strategy and the Environment***, Vol. 30 No. 6, pp. 2814–2829, doi: 10.1002/bse.2895.

Klein, S.P., Spieth, P. and Heidenreich, S. (2021): ***Facilitating business model innovation: The influence of sustainability and the mediating role of strategic orientations***, Journal of Product Innovation Management, Vol. 38 No. 2, pp. 271–288, doi: 10.1111/jpim.12563.

Lit, F.C., Huijben, J.C., Cloodt, M.M. and Paredis, E. (2024): ***Business model innovation in circular start-ups: Overcoming barriers in the circular plastics economy***, International Small Business Journal: Researching Entrepreneurship, Vol. 42 No. 4, pp. 506–550, doi: 10.1177/02662426231217954.

Madsen, H.L. (2020): ***Business model innovation and the global ecosystem for sustainable development***, Journal of Cleaner Production, Vol. 247, p. 119102, doi: 10.1016/j.jclepro.2019.119102.

Massa, L., Tucci, C.L. and Afuah, A. (2017): ***A Critical Assessment of Business Model Research***, Academy of Management Annals, Vol. 11 No. 1, pp. 73–104, doi: 10.5465/annals.2014.0072.

Neumeyer, X. and Santos, S.C. (2018): ***Sustainable business models, venture typologies, and entrepreneurial ecosystems: A social network perspective***, Journal of Cleaner Production, Vol. 172, pp. 4565–4579, doi: 10.1016/j.jclepro.2017.08.216.

Osterwalder, A., Pigneur, Y. and Tucci, C.L. (2005): ***Clarifying Business Models: Origins, Present, and Future of the Concept***, Communications of AIS, Vol. 15, pp. 1–40.

Richardson, J. (2008): ***The business model: an integrative framework for strategy execution***, Strategic Change, Vol. 17 No. 5–6, pp. 133–144, doi: 10.1002/jsc.821.

Ritala, P. and Thomas, L.D.W. (2025): ***Innovation ecosystems***, in Eriksson, P., Montonen, T., Laine, P.-M. and Hannula, A. (Eds.): Encyclopedia of Innovation Management, Edward Elgar Publishing Limited, pp. 1–12.

Roome, N. and Louche, C. (2016): ***Journeying Toward Business Models for Sustainability, Organization & Environment***, Vol. 29 No. 1, pp. 11–35, doi: 10.1177/1086026615595084.

Sarasvathy, S.D. and Ramesh, A. (2019): ***An Effectual Model of Collective Action for Addressing Sustainability Challenges***, Academy of Management Perspectives, Vol. 33 No. 4, pp. 405–424, doi: 10.5465/amp.2017.0090.

Schaltegger, S., Hansen, E.G. and Lüdeke-Freund, F. (2016): ***Business Models for Sustainability: Origins, Present Research, and Future Avenues***, Organization & Environment, Vol. 29 No. 1, pp. 3–10, doi: 10.1177/1086026615599806.

Schaltegger, S., Hörisch, J. and Freeman, R.E. (2019): ***Business Cases for Sustainability: A Stakeholder Theory Perspective***, Organization & Environment, Vol. 32 No. 3, pp. 191–212, doi: 10.1177/1086026617722882.

Schwarz, E.J., Gregori, P., Krajger, I. and Wdowiak, M.A. (2021): ***Entrepreneurial lean thinking for sustainable business modeling: a workshop design for incumbent firms***, Sustainability Management Forum | NachhaltigkeitsManagementForum, doi: 10.1007/s00550-020-00508-y.

Stam, E. and van de Ven, A. (2021): ***Entrepreneurial ecosystem elements***, Small Business Economics, Vol. 56 No. 2, pp. 809–832, doi: 10.1007/s11187-019-00270-6.

Sussan, F. and Acs, Z.J. (2017): ***The digital entrepreneurial ecosystem***, Small Business Economics, Vol. 49 No. 1, pp. 55–73, doi: 10.1007/s11187-017-9867-5.

Thomas, L.D.W. and Autio, E. (2020): ***Innovation Ecosystems in Management***: An Organizing Typology, Oxford Research Encyclopedia of Business and Management, Oxford University Press, doi: 10.1093/acrefore/9780190224851.013.203.

Thomas, L.D.W. and Ritala, P. (2022): ***Ecosystem Legitimacy Emergence: A Collective Action View***, Journal of Management, Vol. 48 No. 3, pp. 515–541, doi: 10.1177/0149206320986617.

Urbinati, A., Franzò, S. and Chiaroni, D. (2021): ***Enablers and Barriers for Circular Business Models: an empirical analysis in the Italian automotive industry***, Sustainable Production and Consumption, Vol. 27, pp. 551–566, doi: 10.1016/j.spc.2021.01.022.

Vermunt, D.A., Negro, S.O., Verweij, P.A., Kuppens, D.V. and Hekkert, M.P. (2019): ***Exploring barriers to implementing different circular business models***, Journal of Cleaner Production, Vol. 222, pp. 891–902, doi: 10.1016/j.jclepro.2019.03.052.

Volkmann, C., Fichter, K., Klofsten, M. and Audretsch, D.B. (2021): ***Sustainable entrepreneurial ecosystems: an emerging field of research***, Small Business Economics, Vol. 56 No. 3, pp. 1047–1055, doi: 10.1007/s11187-019-00253-7.

Wurth, B., Stam, E. and Spigel, B. (2022): ***Toward an Entrepreneurial Ecosystem Research Program***, Entrepreneurship Theory and Practice, Vol. 46 No. 3, pp. 729–778, doi: 10.1177/1042258721998948.

A scientific paper

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EXTRACURRICULAR AND OUT OF-SCHOOL ACTIVITIES AS A FACTOR IN THE DEVELOPMENT OF LEADERSHIP SKILLS IN STUDENTS

ABSTRACT

Developing leadership skills should become a crucial part of the educational process, especially in light of rapid social and technological changes. This paper explores the role of extracurricular and out-of-school activities in the development of leadership skills among students, highlighting their importance in strengthening teamwork, decision-making, and communication skills.

The paper presents the results of a review of scientific literature published in relevant scientific databases (Scopus and Web of Science) with the aim of identifying peer-reviewed scientific papers from 2015 to 2025 on the acquisition of leadership skills through continuous student participation in extracurricular activities. Research shows that participation in such activities positively impacts academic success, increases social connectivity, and contributes to the development of competencies, self-confidence, innovation, responsibility, and entrepreneurial spirit in students. Activities organized within sports and debate clubs, projects, mentorship programs, and volunteering provide participatory learning, which encourages the development of initiative and strategic thinking, while also enhancing the self-confidence necessary for successful leadership. Participation in these activities helps students take responsibility and make decisions in changing environments, preparing them for various professional challenges. Despite the benefits, there are also challenges, such as unequal access to extracurricular and out-of-school activities for all students, overloaded school curricula, and insufficient institutional support and intersectoral collaboration in the development of leadership skills. The paper emphasizes the importance of including activities that foster leadership skills in normative and strategic development documents at all levels of the education system. Therefore, there is a need for continuous educational reforms, improvements in school curricula, as well as the development of teachers' professional competencies to enable students to gain quality leadership experiences. Systematic support, continuous development, and the creation of an encouraging environment for students can significantly contribute to the development of future leaders who will be ready to face the challenges of modern society.

Key words: *Extracurricular and out-of-school activities, Leaders, Participatory learning methods, Entrepreneurship*

1. Introduction

Extracurricular and out-of-school activities are an integral part of the educational process and play a key role in the academic, social, and personal development of students, enabling them to broaden their knowledge, acquire new skills, and explore their interests. The National Educational Standard for the Primary Education System (2008) defines extracurricular activities as organized school activities in which students voluntarily participate, based on their interests, and which take place outside the regular school curriculum. Their value lies in encouraging creativity, developing individual skills, strengthening initiative, and creating a stimulating environment in which students can more freely express their ideas and develop collaborative skills. Every school is obliged to organize extracurricular activities according to the interests and needs of students, as regulated by the Law on Education in Primary and Secondary Schools and the Regulation on Education (Šiljković, Rajić, & Bertić, 2007).
Research results show a strong link between participation in extracurricular activities and academic success, with a positive correlation found with better grades, a higher likelihood of enrolling in higher education institutions, and a stronger sense of belonging to the school community (Broh, 2002). Additionally, participation in school sports teams, music groups, and academic clubs contributes to the development of self-confidence, work habits, responsibility, and social competence, which are key factors for academic and career success (Marsh & Kleitman, 2003). Besides extracurricular activities, students often spend their free time participating in various forms of out-of-school activities, including music and dance schools, foreign language schools, sports clubs, cultural and artistic societies, thematic societies, and various workshops. Puževski (2002) points out that out-of-school activities include school educational activities outside formal class hours, as well as programs organized by community organizations, which allow participation not only of students but also other members of the local community. Out-of-school activities enable students to participate in a broader social network, thus developing a sense of responsibility, adaptability, and cooperation, which is essential for their future academic and professional success. Cindrić (1992) defines out-of-school activities as organized programs conducted by institutions, associations, or clubs outside the school system, independently or in cooperation with the school, with their particular value being the encouragement of social integration and empowering students for active participation in the community. Research shows that students most often engage in sports activities, learning foreign languages, and music activities, while literary and drama activities are represented to a lesser extent (Ilišin, Marinović-Bobinac, & Radin, 2001). Out-of-school activities enable students to participate in a broader social network, thus developing a sense of responsibility, adaptability, and cooperation, which is essential for their future academic and professional success. Cindrić (1992) defines out-of-school activities as organized programs conducted by institutions, associations, or clubs outside the school system, independently or in cooperation with the school, with their particular value being the encouragement of social integration and empowering students for active participation in the community.

The pedagogical and psychological aspects of extracurricular and out-of-school activities highlight their importance in the development of students' socio-emotional skills and the prevention of risky behaviors. According to Brown and Evans (2002), student involvement in school clubs and organizations helps positive personality development and reduces the likelihood of deviant behavior patterns, while Duncan (1996) emphasizes that these activities

allow students to discover their own potential, strengthen character, develop social competencies, and establish quality relationships with adults outside the family environment. Given the long-term benefits of extracurricular and out-of-school activities, educational institutions must systematically develop and improve programs that enable students to develop key skills in a stimulating and structured environment. Systematic integration of these activities into the education system contributes not only to academic success but also to the development of emotional intelligence, leadership skills, and a sense of social responsibility, which are recognized skills in the contemporary educational and professional context (Jones & Iredale, 2010).

Extracurricular activities have been linked to improved academic performance and the acquisition of complementary skills. For instance, participation in these activities can lead to higher grade point averages and better educational outcomes (Buckley & Lee, 2018; Marsh, 1992). Additionally, extracurricular activities are associated with the development of self-regulatory mechanisms that support academic success and emotional well-being (Guilmette, Mulvihill, Villemaire-Krajden, & Barker, 2019). Beyond academics, extracurricular activities contribute to emotional well-being and social development. They provide a platform for students to form and regulate goals, which are crucial for success and well-being during the transition to adulthood (Guilmette et al., 2019). Participation in extracurricular activities can also mitigate the negative effects of discrimination and enhance psychological health, particularly for underrepresented students (Billingsley & Hurd, 2019). Extracurricular activities offer significant benefits for disadvantaged youth, although participation rates may vary based on socioeconomic status, race, and other factors. These activities can provide greater benefits to disadvantaged youth, depending on the type of activity and the individual's risk status (Heath, Anderson, Turner, & Payne, 2018). Participation in extracurricular activities fosters a greater sense of connection to school, which is a predictor of school success and positive student behavior (Brown & Evans, 2002). Extracurricular activities also play a role in identity formation and attachment to non-familial adults, which can influence educational and behavioral outcomes (Eccles, Barber, Stone, & Hunt, 2003). While many studies highlight the positive associations between extracurricular activities and various outcomes, some research suggests that these associations are not necessarily causal. Methodological differences and assumptions in theoretical explanations can lead to seemingly contradictory results (Shulruf, Tumen, & Tolley, 2008; Hunt, 2005). However, the overall evidence supports the notion that extracurricular activities are beneficial extensions of the traditional curriculum, contributing positively to a wide range of student outcomes (Marsh, 1992). By participating in various activities, students (through play and in a fun way) build new or change old attitudes, create positive emotions and a sense of belonging, and learn leadership and public speaking skills, critical thinking, tolerance, and teamwork (Mlinarević & Brust Nemet, 2012).

2. The Importance of Developing Students' Leadership Skills

Leadership skills are part of entrepreneurial competencies that are included in all European national curricula as one of eight key competencies (Šutalo, 2011). Leadership is defined in various ways, but more and more research focuses on a relational approach, where leadership is not limited to formal or elected positions. Komives et al. (2006) describe leadership as a dynamic relational construct in which anyone can be a leader. Leadership is now recognized as a key skill necessary for personal and professional success, especially in the context of accelerated social and technological change. Through the development of leadership skills, individuals acquire abilities such as teamwork, decision-making, and effective communication,

which are crucial not only for academic success but also for later contributions to the community and professional careers (Jones & Iredale, 2010).

These skills are further developed through extracurricular and out-of-school activities, where participants take responsibility, collaborate in teams, and face the challenges of a dynamic environment. Developing leadership skills in students is a crucial aspect of their personal and educational development, and participation in extracurricular and out-of-school activities provides them with the opportunity to gain practical experience in leadership, collaboration, and strategic decision-making.

Leadership skills can be defined as a complex set of abilities, attitudes, and behaviors that enable individuals to take initiative, effectively manage team processes, make responsible decisions, and positively influence the peer community (Kouzes & Posner, 2017). Skills that make a young leader successful include developed communication skills, which involve clear and reasoned expression of thoughts, active listening, and providing constructive feedback. Additionally, the ability to make analytical and strategic decisions is key, through which students evaluate different options, identify optimal solutions, and implement them (Rahayu & Dong, 2023).

Self-awareness and self-confidence also contribute to their preparation for leadership roles, as awareness of their strengths and areas for development encourages autonomous action, responsible resource management, and initiating changes in the school and wider community. Since leadership is inseparable from teamwork, collaboration with different groups encourages students to effectively coordinate joint activities, constructively resolve conflicts, and appreciate a plurality of perspectives (Broh, 2002). It is especially important to develop a sense of responsibility and consistency in fulfilling obligations, thereby strengthening the credibility and integrity of students in the role of leader.

Empathy, as an integral part of emotional intelligence, enables young leaders to understand and recognize the needs of others, which helps create a supportive and inclusive community and provide support to their peers in difficult situations. Furthermore, creativity and innovation are key elements of modern leadership, as they enable the generation of original solutions, adaptation to changing circumstances, and the promotion of positive changes in the educational and social context. By systematically developing these skills through experiential learning and practical challenges, students are profiled as responsible and inspiring future leaders, ready to act effectively in complex dynamic environments (Rocco & Griffin, 2015).

3. Development of Leadership Skills in Students and Teachers Through Continuous Participation in Extracurricular Activities

Extracurricular activities are a key element in the development of a student's cognitive and socio-emotional skills, offering the opportunity to improve skills that go beyond the framework of formal education. By participating in various forms of extracurricular engagement, including those aimed at developing leadership skills, students gain experiences that enable effective communication, collaboration, decision-making, and taking responsibility. These skills play an important role in their academic success and later professional development (Bayudan, Linis, Villar, Padilla, Francisco, Ayagan, & Limos-Galay, 2024).

Furthermore, longitudinal studies show a long-term link between participation in extracurricular activities and career success. Students who actively participate in extracurricular programs are more likely to develop communication and leadership skills that employers highly value (Gerber, 1996). Research also confirms that participation in extracurricular activities is associated with increased occupational mobility, career advancement, and a higher standard of social life and engagement in adulthood (Mahoney, Cairns, & Farmer, 2003; Zaff, Moore, Romano, & Williams, 2003). In addition, students who take on leadership roles in organizations and projects develop key skills in coordinating and delegating tasks, preparing them for complex managerial roles in the future (Dhanmeher, 2014). Team management, strategic planning, and conflict resolution are integral parts of their experience, enabling them to acquire key skills for their professional and personal development. Extracurricular activities like sports activities, volunteering, and project-based initiatives contribute to the development of students' leadership skills by promoting teamwork, responsibility, communication, and decision-making abilities. Team sports such as football, basketball, or volleyball develop cooperation skills, strategic planning, and quick decision-making under pressure (Hancock, Adler, & Côté, 2013; Camiré, Trudel, & Forneris, 2012). Regular participation in competitions encourages: communication skills through coordination with teammates; emotional intelligence in resolving team conflicts; responsibility towards shared goals. Leading student councils or organizing humanitarian actions enables: gaining experience in project planning and budget management (Dugan & Komives, 2010); developing persuasive skills through public speaking (Kouzes & Posner, 2017), and building empathy through direct contact with social issues (Astin & Sax, 1998). Working in robotics teams or scientific associations fosters: critical thinking through solving complex problems (Fischer, Rohde, & Wüst, 2020); innovation in finding creative solutions, and presentation skills when presenting results to a professional audience (Soria, Nobbe, & Fink, 2013).

Leadership competencies are strengthened through: practical experience – real challenges require the application of theoretical knowledge in dynamic situations (Kouzes & Posner, 2017); mentorship – experienced activity leaders provide feedback and model optimal strategies (Dugan & Komives, 2010), and reflective practice – systematic evaluation of one's achievements and shortcomings through journals or group analyses (Fischer, Rohde, & Wüst, 2020). Key competencies developed include the ability to motivate a team, strategic thinking, time management, and adaptability to change. Recent studies emphasize that continuous participation and an interdisciplinary approach to activities contribute most to building leaders (Soria, Nobbe, & Fink, 2013; Hancock, Adler, & Côté, 2013).

4. Challenges and Obstacles in the Development of Leadership Skills

Developing leadership skills is one of the key aspects of modern education, but despite well-known benefits, students face many challenges that can limit their potential. One of the biggest obstacles is unequal access to quality extracurricular activities, especially for students from families with lower socioeconomic status. Limited resources and financial barriers can significantly reduce opportunities to participate in programs that foster leadership development, which in turn can affect the professional and academic success of these students (Rahayu & Dong, 2023). Leadership development enhances both professionally oriented and self-centric aspects of a student's personality, contributing to their success and competitiveness (Zhou, Anishchenko, Vasylenko, Iaremenko, & Fomin, 2021). Leadership skills foster responsibility, decision-making, and adaptability, preparing students to effectively engage with society and manage projects (Aitzhanova & Zhumabay, 2021; Tojiboeva, 2020).

Also, the school environment often does not provide students with adequate opportunities to take responsibility and develop leadership abilities. Overly hierarchical educational systems, in which students do not actively participate in decision-making or managing school activities, can reduce their motivation and leadership skills (Mawaddah et al., 2022). According to Marušić (2007), 70% of students do not receive enough encouragement to propose new ideas, suggest new solutions to problems, or self-assess their own work. The lack of participation in school structures makes it difficult for students to develop key leadership skills, such as strategic thinking, teamwork, and decision-making in complex situations.
In addition to structural obstacles, students who take on leadership roles often face the challenge of balancing academic and extracurricular obligations. Intensive involvement in extracurricular activities can lead to increased cognitive load, which can negatively affect their academic success (Amez, Baert, & Heydencamp, 2021). In such a context, time management and prioritization become essential skills, further developing students' organizational and self-regulation abilities.

Research results show that 70% of teachers employed in Croatian primary schools believe they are not sufficiently trained to develop entrepreneurial competencies, although they are key to their formation (Marušić, 2007). Teachers' education and professional development are necessary to encourage students' creativity, innovation, and leadership skills.
To overcome these challenges, schools must implement targeted mentoring programs in extracurricular activities, providing students with systematic support in developing their leadership skills (Bayudan et al., 2024). Furthermore, school administrations should regularly hold seminars and workshops on leadership to help students build self-confidence and develop practical leadership skills (Tucci, Tong, Chia, & DiVall, 2019). There is also a need to provide more opportunities for practical leadership experience, as theoretical learning without concrete application in real-life situations can limit the development of students' skills and self-confidence (Shakil & Denny 2024).

Ultimately, developing students' leadership skills requires systematic adaptation of educational policies that enable equal access to extracurricular activities, create a stimulating environment for student leaders, and provide necessary support through mentoring programs and practical leadership opportunities.

5. Methodology

5.1. Research Aim and Questions

The paper presents the results of a review of scientific literature published in relevant scientific databases (Scopus and Web of Science) with the aim of identifying peer-reviewed scientific papers from 2015 to 2025 on the acquisition of leadership skills through continuous student participation in extracurricular, and out-of-school activities. The following research questions arise from the research aim:

> RQ1: Which extracurricular and out-of-school activities contribute most to the development of leadership skills?
> RQ2: Are there studies that have established a positive correlation between leadership and continuous participation in extracurricular, and out-of-school activities among students?

5.2. Procedure, Sample, and Research Instrument

A systematic review of the literature on the acquisition of leadership skills by students through participation in extracurricular, and out-of-school activities followed the recommendations of a multi-phase approach for systematic reviews (Mangaroska & Giannakos, 2019). The systematic review was conducted in three phases: identification of relevant scientific papers in the Scopus and Web of Science databases published from 2015 to 2025, review of abstracts, and review of full papers. In the first phase, the following keywords were searched individually and in combination: student leadership skills, extracurricular activities, and out-of-school activities. A total of 28 papers containing these keywords were found. However, through further selection aligned with the research questions and studies in the field of education, 17 papers were chosen. These papers come from the field of education and from English-speaking countries and include empirical research. In the second phase, the main findings of each study were analyzed to identify key conclusions regarding the development of leadership skills in students through continuous participation in extracurricular and out-of-school activities.

6. Research Results and Discussion

The qualitative analysis includes 17 scientific papers that meet the search criteria and focus on the development of leadership skills among students through participation in extracurricular and out-of-school activities. All papers were selected from educational contexts in English-speaking countries and contain empirical research. The aim of the analysis was to identify key insights into how extracurricular activities contribute to the development of leadership competencies and which practices are most effective within educational systems (Table 1).

Table 1: Tabular Overview of Key Studies

Author(s) and Year	Key Research Points	Conclusions
Feraco, Resnati, Fregonese, Spoto, & Meneghetti (2021)	Connection between soft skills and academic success	Extracurricular activities positively influence leadership skills and academic performance
Forneris, Camiré, & Williamson (2015)	Impact of activities on developmental outcomes and engagement	Direct link between participation and leadership development in high school students
Fujii, Kobayasi, Enns, & Tempski (2022)	Motivation and outcomes of participation among medical students	Participation enhances leadership and professional competencies
Li & Kim (2021)	Postgraduate attributes and theoretical framework	Leadership skills are developed through structured extracurricular programs
Bayudan et al. (2024)	Correlation between activities and leadership skills	Strong link between activities and leadership development
Dampson, Havor, & Laryea (2018)	Socio-emotional and cognitive skills	Activities encourage initiative, adaptability, and strategic thinking
Kim & Wargo (2022)	Perception of leadership and social values	Self-perception of leadership leads to social engagement
Jin (2023)	Socio-emotional skills	Empathy, self-awareness, and emotional regulation are strengthened through team-based activities

Author(s) and Year	Key Research Points	Conclusions
Kosteas (2022); Mkude & Mubofu (2022)	Long-term impact of activities	Activities increase the likelihood of holding managerial positions in adulthood
Tucci et al. (2019)	Informal assumption of leadership roles	Leadership is best developed through practical experience
Li & Kim (2021)	Leadership development programs	Programs improve leadership readiness and engagement
Chen (2019); Pierce et al. (2020)	Experiential learning	Sports and teamwork are key to the practical development of skills
Pongpaichet et al. (2022)	Evaluation using machine learning	Continuous assessment of students' potential is needed
Bisland (2004)	Lack of leadership in the curriculum	Leadership is not considered an academic priority
Coffey & Lavery (2018)	Leadership in primary school	Greater focus on younger students is needed
Zada & Zeb (2021)	Participatory methods	Free-time activities can systematically develop leadership skills
Pavličević Franić, & Vukelić (2021)	Model for the development of leadership skills through extracurricular activities	Empirically confirms the increase of leadership competencies among secondary school students in Croatia

Source: Authors

Leading countries in the field of leadership development in education are: USA − through debates, student councils, STEM clubs, and sports teams, leadership is part of school life. Many districts implement special Leadership Academies; UK − implementation of the "Citizenship" program, which includes the development of social responsibility and leadership through the school community, and Canada – programs like "Student Voice" and "Leadership Camp" promote active participation and student leadership. The most suitable model in the Republic of Croatia would be the introduction of extracurricular, and out-of-school programs focused on teamwork, self-governance, and public speaking (e.g., debate clubs, parliamentary simulations, volunteering). It is essential to develop systematic mentorship, involve parents and the community, and ensure institutional support (such as appointing a school leadership coordinator). In Croatian educational context advantages are: opportunities through extracurricular activities (sports, music, drama clubs) and some elements of civic education are already present. Disadvantages are lack of structured programs for leadership development; leadership is not recognized as a learning outcome, and lack of teacher training in leadership mentoring. Comparison with international practices highlights the need for systematic integration of leadership skills into the Croatian education system. Extracurricular and out-of-school activities offer the most flexible and effective framework for their introduction, with a need for clear program guidelines and professional support.

7. Conclusion

Extracurricular and out-of-school activities play a significant role in developing students' leadership skills by offering opportunities to gain practical experience in leadership, decision-making, and teamwork. Their primary purpose is to foster the development of traits essential for successful entrepreneurship, such as creativity, self-confidence, adaptability, innovation,

and a willingness to take calculated risks. In addition to shaping personal characteristics, it is important to provide students with knowledge about professional and entrepreneurial opportunities. High-quality educational content and hands-on activities can help students better understand the labor market, business planning, and fundamental economic concepts, thereby enhancing their competitiveness and preparedness to enter the entrepreneurial world.

Research has shown that various extracurricular and out-of-school programs effectively support the development of leadership abilities and serve as valuable tools in shaping future leaders. However, their full potential depends on well-designed educational policies that promote the real-life application of acquired skills. Especially notable is extracurricular and out-of-school activities that use participatory methods, such as debates, sports, artistic pursuits, and organizational development programs. Leadership skills are also a key component of 21st century competencies, which are essential for adapting successfully to a dynamic and ever-changing environment.

Comparing Croatian practices with international models highlights the urgent need to systematically integrate leadership development into the national education system. Extracurricular and out-of-school activities represent the most flexible and effective framework for doing so, provided that clear program guidelines and professional support are ensured.

REFERENCES

Aitzhanova, R., & Zhumabay, M. (2021): ***Formation of students ' leadership skills in the learning process,*** Bulletin of KazNPU named after Abai. Series: Psychology, Vol. 66, No. 1, pp. 35-39. https://doi.org/10.51889/2021-1.1728-7847.06

Amez, S., Baert, S., Heydencamp, E., & Wuyts, J. (2021): ***Does multitasking affect students' academic performance? Evidence from a longitudinal study,*** IZA Institute of Labor Economics, pp. 1-18.

Astin, A. W., & Sax, L. J. (1998): ***How undergraduates are affected by service participation***, Journal of College Student Development, Vol. 39, No. 3, pp. 251-263.

Bayudan, M. E., Linis, M. D., Villar, J. N. D., Padilla, V. D., Francisco, A. P. Y., Ayagan, N. M., & Limos-Galay, J. A. (2024): ***Co-curricular activities and leadership skills of student leaders of senior high school students in Divine Word College of San Jose,*** International Journal of Research, Vol. 8, No. 4, pp. 93-98.

Billingsley, J., & Hurd, N. (2019): ***Discrimination, mental health and academic performance among underrepresented college students: the role of extracurricular activities at predominantly white institutions,*** Social Psychology of Education, Vol. 22, pp. 421-446. https://doi.org/10.1007/S11218-019-09484-8

Bisland, A. (2004): ***Developing leadership skills in young gifted students,*** Gifted Child Today, Vol. 27, pp. 24-27. https://doi.org/10.1177/107621750402700108

Brown, R. & Evans, W. (2002): ***Extracurricular Activity and Ethnicity***, Urban Education, Vol. 37, pp. 41-58. https://doi.org/10.1177/0042085902371004

Broh, B. A. (2002): ***Linking extracurricular programming to academic achievement: Who benefits and why?*** Sociology of Education, Vol. 75, No. 1, pp. 69-91. https://doi.org/10.2307/3090254

Buckley, P. & Lee, P. (2018): ***The impact of extra-curricular activity on the student experience,*** Active Learning in Higher Education, Vol. 22, pp. 37-48. https://doi.org/10.1177/1469787418808988

Camiré, M., Trudel, P., & Forneris, T. (2012): ***Coaching and transferring life skills: Philosophies and strategies used by model high school coaches***, The Sport Psychologist, Vol. 26, No. 2, pp. 243-260. https://doi.org/10.1123/tsp.26.2.243

Chen, W. (2019): ***A Case Study on Developing Students' Leadership Skills via Team Work Activities,*** Open Journal of Social Sciences, Vol. 7, No. 10, pp. 414-425. https://doi.org/10.4236/jss.2019.710036

Cindrić, M. (1992): ***Extracurricular and out-of-school activities of primary school students [Izvannastavne i izvanškolske aktivnosti učenika osnovne škole]***, Life and school [Život i škola], Vol. 41, No. 1, pp. 49-68.

Coffey, A. & Lavery, S. (2018): ***Student leadership in the middle years: A matter of concern,*** Improving Schools, Vol. 21, pp. 187-200. https://doi.org/10.1177/1365480217732223

Dampson, D. G., Havor, F. M., & Laryea, P. (2018): ***Distributed leadership as an instrument for school improvement: The study of public senior high schools in Ghana,*** Journal of Educational Leadership, Vol. 6, No. 2, pp. 79-85. https://doi.org/10.204481/journal.509.2018-52-79-85

Dhanmeher, B. R. (2014): ***Impact of co-curricular activities on the non–academic development of junior college students*** [Unpublished master's thesis], DY Patil University, India.

Dugan, J. P., & Komives, S. R. (2010): ***Influences on college students' capacities for socially responsible leadership***, Journal of College Student Development, Vol. 51, No. 5, pp. 525-549. https://doi.org/10.1353/csd.2010.0009

Duncan, S. (1996): ***Family matters: What is the role of "extracurricular" activities?*** MSU Extension Service. MSU-Bozeman Communication Services. http://www.montana.edu/wwwpb/home/extra.html, (accessed 1 April 2025)

Eccles, J., Barber, B., Stone, M., & Hunt, J. (2003): ***Extracurricular activities and adolescent development,*** Journal of Social Issues, Vol. 59, pp. 865-889. https://doi.org/10.1046/J.0022-4537.2003.00095.X

Feraco, T., Resnati, D., Fregonese, D., Spoto, A., & Meneghetti, C. (2021): ***Soft skills and extracurricular activities sustain motivation and self-regulated learning at school***, The Journal of Experimental Education, Vol. 90, pp. 550-569. https://doi.org/10.1080/00220973.2021.1873090

Fischer, K., Rohde, A., & Wüst, K. (2020): ***Extracurricular activities and the development of soft skills in higher education***, International Journal of Educational Research, Vol. 103, pp. 101602. https://doi.org/10.1016/j.ijer.2020.101602

Forneris, T., Camiré, M., & Williamson, R. (2015): ***Extracurricular activity participation and the acquisition of developmental assets: differences between involved and noninvolved canadian high school students***, Applied Developmental Science, Vol. 19, 47-55. https://doi.org/10.1080/10888691.2014.980580

Fujii, R., Kobayasi, R., Enns, S., & Tempski, P. (2022): ***Medical students' participation in extracurricular activities: motivations, contributions, and barriers. a qualitative study***, Advances in Medical Education and Practice, Vol. 13, pp. 1133-1141. https://doi.org/10.2147/amep.s359047

Gerber, S. (1996): ***Extracurricular activities and academic achievement***. Journal of Research and Development in Education, Vol. 30, pp. 42-50.

Guilmette, M., Mulvihill, K., Villemaire-Krajden, R., & Barker, E.T. (2019): ***Past and present participation in extracurricular activities is associated with adaptive self-regulation of goals, academic success, and emotional wellbeing among university students***, Learning and Individual Differences, Vol. 73, No. 3, pp. 8-15. https://doi.org/10.1016/j.lindif.2019.04.006

Hancock, D. J., Adler, A. L., & Côté, J. (2013): ***A proposed theoretical model to explain relative age effects in sport***, European Journal of Sport Science, Vol. 13, No. 6, pp. 630–637. https://doi.org/10.1080/17461391.2013.775352

Heath, R.D., Anderson, C., Cureton Turner, A., & Payne, C.M. (2018): ***Extracurricular activities and disadvantaged youth: a complicated—but promising—story***, Urban Education, Vol. 57, No. 8, 004208591880579. https://doi.org/10.1177/0042085918805797

Hrvatski sabor. (2008): ***Državni pedagoški standard osnovnoškolskog sustava odgoja i obrazovanja (NN 63/2008)***, Narodne novine, https://narodne-novine.nn.hr/clanci/sluzbeni/2008_06_63_2129.html, (accessed 1 April 2025)

Hunt, H. (2005): ***The effect of extracurricular activities in the educational process: influence on academic outcomes?*** Sociological Spectrum, Vol. 25, pp. 417-445. https://doi.org/10.1080/027321790947171

Ilišin, V., Marinović-Bobinac, A., & Radin, F. (2001): **Children and Media** [*Djeca i mediji]*, Institut za društvena istraživanja, Zagreb.

Jin, F. (2023): ***Students' leadership traits, social-emotional skills and extra-curricular engagement: towards a proposed enhancement plan***, International Journal of Creative Research Thoughts, Vol. 11, pp. 330-334.

Jones, B. & Iredale, N. (2010): ***Enterprise education as pedagogy***, Education + Training, Vol. 52, No. 1, pp. 7-19.

Kim, J. & Wargo, E. (2022): ***The Interface of Leadership Development and Extracurricular Activity: Exploring the Effects of Involvement in Extracurricular Activity on Community***

***Leadership**,* Leadership and Research in Education: The Journal of the Ohio Council of Professors of Educational Administration (OCPEA), Vol. 7, No. 1, pp. 11-36.

Komives, S. R., Longerbeam, S. D., Owen, J. E., Mainella, F. C., & Osteen, L. (2006): ***A leadership identity development model: Applications from a grounded theory**,* Journal of College Student Development, Vol. 47, No. 4, pp. 401-418. https://doi.org/10.1353/csd.2006.0048

Kouzes, J. M. & Posner, B. Z. (2017): ***The student leadership challenge: Five practices for becoming an exemplary leader***, Jossey-Bass, San Francisco.

Li, B. & Kim, S. (2021): ***Developing Student Leadership Readiness, Core Leadership Skills to Enhance Student Engagement through Organization Development Intervention: Action Research at Zhejiang Yuexiu University of Foreign Languages in Zhejiang Province, the People's Republic of China***. Abac odi journal vision. action. outcome, Vol. 8, No. 1, pp. 82-103. https://doi.org/10.14456/ABACODIJOURNAL.2021.6

Mangaroska, K. & Giannakos, M. (2019): ***Learning analytics for learning design: a systematic literature review of analytics-driven design to enhance learning***, IEEE Transactions on Learning Technologies, https://doi.org/10.1109/TLT.2018.2868673 , (accessed 1 April 2025)

Mahoney, J. L., Cairns, B. D., & Farmer, T. W. (2003): ***Promoting interpersonal competence and educational success through extracurricular activity participation***, Journal of Educational Psychology, Vol. 95, No. 2, pp. 409-418. https://doi.org/10.1037/0022-0663.95.2.409

Marsh, H. (1992): ***Extracurricular activities: Beneficial extension of the traditional curriculum or subversion of academic goals?*** Journal of Educational Psychology, Vol. 84, pp. 553-562. https://doi.org/10.1037/0022-0663.84.4.553

Marsh, H. W. & Kleitman, S. (2003): ***School athletic participation: Mostly gain with little pain**,* Journal of Sport and Exercise Psychology, Vol. 25, No. 2, pp. 205-228. https://doi.org/10.1123/jsep.25.2.205

Marušić, I. (2007): ***Entrepreneurship as a Key Competence in Education: An Attempt at Conceptualization.*** 18th Ramiro and Zoran Bujas Days – Program and Abstracts of Presentations. Department of Psychology, Faculty of Humanities and Social Sciences, University of Rijeka, 2007, pp. 111-111.

Pavličević Franić, I., & Vukelić, A. (2021): ***Leadership skills development through extracurricular activities in Croatian secondary schools***, Croatian Journal of Education, Vol. 23, No. 3, pp. 877-902. https://doi.org/10.15516/cje.v23i3.4151

Pierce, S., Erickson, K., & Sarkar, M. (2020): ***High school student-athletes' perceptions and experiences of leadership as a life skill***, Psychology of Sport and Exercise, Vol. 51, pp. 101716. https://doi.org/10.1016/j.psychsport.2020.101716

Pongpaichet, S., Nirunwiroj, K., & Tuarob, S. (2022): ***Automatic Assessment and Identification of Leadership in College Students***, IEEE Access, Vol. 10, pp. 79041-79060. https://doi.org/10.1109/access.2022.3193935

Puževski, V. (2002): ***Open Door School*** [*Škola otvorenih vrata]*, Naklada Slap, Zagreb.

Rahayu, A. P. & Dong, Y. (2023): ***The relationship of extracurricular activities with students' character education and influencing factors: A systematic literature review***, Al-Ishlah: Jurnal Pendidikan, Vol. 15, No. 1, pp. 459-474. https://doi.org/10.35445/alishlah.v15i1.2968

Rocco, M. & Griffin, K. (2015): ***Exploring leadership: For college students who want to make a difference by Susan R. Komives, Nance Lucas, and Timothy R. McMahon***, Journal of College Student Development, Vol. 56, No. 1, pp. 107-109. https://doi.org/10.1353/csd.2015.0008

Shakil, A. & Denny, P. (2024): ***Enhancing student engagement in large-scale capstone courses: An experience report,*** Proceedings of the 2024 on Innovation and Technology in Computer Science Education V. Vol. 1, pp. 722-728.

Shulruf, B., Tumen, S., & Tolley, H. (2008). ***Extracurricular activities in school, do they matter?*** Children and Youth Services Review, Vol. 30, pp. 418-426. https://doi.org/10.1016/J.CHILDYOUTH.2007.10.012

Siahaan, A., Rafida, T., & Mawaddah, R. (2022): ***The influence of organizational culture, leadership style of the head of the madrasah, and work motivation on the professional teachers of private Ibtidaiyah madrasahs in Batang Kuis District, Deli Serdang Regency***, Edutec: Journal of Education and Technology, Vol. 5, No. 3, pp. 705-721.

Soria, K. M., Nobbe, J., & Fink, A. (2013): ***Examining the impact of study abroad participation on leadership development among college students***, Journal of Student Affairs Research and Practice, Vol. 50, No. 1, pp. 1-20. https://doi.org/10.1515/jsarp-2013-0001

Šiljković, Ž., Rajić, V., & Bertić, D. (2007): ***Extracurricular and out-of-school activities*** [Izvannastavne i izvanškolske aktivnosti], Odgojne znanosti, Vol. 9, No. 2, pp. 133-145.

Šutalo, V. (2011): ***Entrepreneurial Competencies and Collaborative Entrepreneurship: A Path Toward Change and the Improvement of Program and Education Quality,*** [Poduzetničke kompetencije i suradničko poduzetništvo: Put do promjena i unaprjeđenja kvalitete programa i obrazovanja], Učenje za poduzetništvo, Vol. 1, No. 1, pp. 279-287.

Tojiboeva, N. (2020): ***Development Of Leadership And Management Skills For Students In Modern Education Conditions.*** JournalNX - A Multidisciplinary Peer Reviewed Journal, pp. 1066-1070, https://repo.journalnx.com/index.php/nx/article/view/1754, (accessed 1 April 2025)

Tucci, M., Tong, K., Chia, K., & DiVall, M. (2019): ***Curricular and co-curricular coverage of leadership competencies and the influence of extracurricular engagement on leadership development,*** American Journal of Pharmaceutical Education, Vol. 83, No. 2, pp. 6535. https://doi.org/10.5688/ajpe6535

Zada, N. Y. & Zeb, A. (2021): ***The role of co-curricular activities in leadership skills' development among university students***, Journal of Social Sciences Review, Vol. 1, No. 2, pp. 38-52. https://doi.org/10.54183/jssr.v1i2.8

Zaff, J., Moore, K., Romano, A., & Williams, S. (2003): ***Implications of extracurricular activity participation during adolescence on positive outcomes***, Journal of Adolescent Research, Vol., 18, No. 6, pp. 599-630. https://doi.org/10.1177/0743558403254779

Zhou, Y., Anishchenko, V., Vasylenko, O., Iaremenko, N., & Fomin, M. (2021): ***Leadership development in students as part of attitude development***, International Journal of Education and Information Technologies, Vol. 15, pp. 202-204. https://doi.org/10.46300/9109.2021.15.21

A scientific paper

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GENDER DISPARITIES IN ENTREPRENEURSHIP: A CROATIAN PERSPECTIVE

ABSTRACT

Entrepreneurship is a key element of economic growth and development. Traditionally, men have been attributed a greater inclination towards entrepreneurship, but more and more women are entering this world, facing stereotypes and challenges. Women's entrepreneurship is crucial for economic development and social transformation, despite specific difficulties related to socio-cultural influences and access to resources. This paper explores existing knowledge about women in entrepreneurship and analyses perceptions about them. The research was conducted using a questionnaire in which data was collected from the respondents regarding their perceptions of women in entrepreneurship and analysed using descriptive statistics, Pearson Chi-square test and Mann-Whitney U test. A survey of 95 respondents (56 women and 39 men) showed that women highlight the inability to advance, the desire for independence, flexibility and the realization of their own ideas as their main motives for entrepreneurship. They see gender inequality and fear of failure as significant challenges. Men are more likely to believe that men are more suitable for managerial positions, that women are more emotionally driven in leadership, and that women contribute less to innovations in the market.

Key words: *Female entrepreneurship, Gender, Motives, Challenges.*

1. Introduction

Entrepreneurship can be understood as the creation of an innovative economic organisation or network of organisations with the aim of achieving profit or growth under conditions of uncertainty and risk. It is also seen as a way of thinking and acting that is characterised by proactivity and innovation. Traditionally, men are seen as more suitable for entrepreneurial activities, which has even led to the paradigm “think entrepreneur – think male” (Laguía et al., 2019). According to Gupta et al. (2009), entrepreneurship is usually seen as a male activity by both men and women (male gender role stereotype). Nevertheless, more and more women are

becoming involved in starting an entrepreneurial venture. At the same time, they are confronted with various stereotypes, challenges and negative comparisons with men. Women in entrepreneurship represent a crucial element of economic development and social change (Brush et al., 2009, Minniti, et al., 2010, GEM, 2023), although they face distinct difficulties that affect their entrepreneurial journey. The field of female entrepreneurship is shaped by socio-cultural influences, access to resources and the changing dynamics of gender roles in different situations.

The position of women in entrepreneurship and in business in general has changed throughout history, although they have almost always faced significantly more and different challenges than men. Despite all these challenges, they have managed to find ways to get involved in entrepreneurial and business life, make a positive difference and leave an impact. This paper aims to provide an overview of current research on women in entrepreneurship through a literature review, and to examine how women in entrepreneurship are perceived by analysing data collected in our study.

2. Theoretical background

Brush et al. (2019) noted that the premise that every entrepreneur has an equal chance of success inside the entrepreneurship ecosystem, as well as equal access to resources, participation, and support, forms the basis of the majority of entrepreneurship ecosystem frameworks, however there is strong evidence that the involvement, resource accessibility, and ecosystem outcomes of female entrepreneurs differ from those of male entrepreneurs. Women entrepreneurship plays a pivotal role in both social development and economic growth in countries. Through their entrepreneurial activities, women contribute to job creation and innovation in various sectors. Historically, women's participation in business creation is lower than men's, with around 10.9% of women compared to 13.8% of men starting new businesses (GEM, 2023). Research has shown that there are differences between women and men, even when they engage in entrepreneurial activities. Women bring innovative and creative ideas and solutions to their work, but also focus on solving social problems and improving the community.

According to the Global Entrepreneurship Monitor, the higher rates of female entrepreneurial activities are seen in low-income countries due to limited employment opportunities and small market size (GEM, 2023). Therefore, female entrepreneurship should be seen as an important driver of economic growth in developing countries as it plays a leading role in creating productive work, realising gender equality and reducing poverty (Da Vita et al., 2014). The largest gender gap in overall entrepreneurial activity is seen in high-income countries where working-age adults have multiple alternatives to income generation and wage labour (GEM, 2023). Due to the increasing stereotypes in society, women today mostly turn to activities that are familiar to them, such as services in the food, cosmetics, fashion or retail industries (Galić, 2011). There are significant discrepancies between the perceived and actual characteristics of female and male entrepreneurs, which emphasises the need to change perceptions and promote the growth of female entrepreneurship, which is crucial for economic development in any country (Vrdoljak Raguž, 2020).

2.1. Characteristics, motives and challenges of women entrepreneurs

Research field focusing on female entrepreneurship is still relatively young (Minniti, 2009). However, as the research body develops the entrepreneurship is no longer being considered as gender neutral concept (Bruni et al., 2004). Likewise, the entrepreneur is no longer one having

the main roll being referred to as a generic creature (De Bruin et al., 2006). Since the entrepreneurial landscape became increasingly diverse, it is crucial to examine the impact of gender roles and biases in the entrepreneurship (Compagno et al., 2024).

Characteristic of female and male entrepreneurs are being explored and compared in different contexts. There has been a significant number of research focusing on characteristic of women entrepreneurs as well as their motives for engaging in entrepreneurial activities. Shabbir and Di Gregorio (1996) note that desire for flexibility, job satisfaction and quality of life have been identified as significant in the entrepreneurial decisions made by women. Furthermore, entrepreneurship can be an interesting option for women that left corporate career due to frustration, discontentment and discrimination (Heilman and Chen, 2003) or for those women who lack of opportunities for advancement at their current jobs (Marlow and McAdam, 2013). Martínez-Rodríguez et al. (2022) explained that more women enter into entrepreneurship due to necessity rather than in pursuit of opportunity. However, according to new data from Global Entrepreneurship monitor Women report (2023) it has been noted that over the past two decades, opportunity recognition has increased globally by almost four-fifths for women, from an average of 29.2% in 2001-2005 to 51.9% in 2021-2023.

Women in business have many unique qualities that contribute to the success of the organisation but still the presence of women in entrepreneurial careers remains low and the ventures led by women are often in low value-added sectors (Marlow et al., 2008). Majority of women-owned businesses are in the retail, catering, food and health/education service sectors (Galić, 2011). Female entrepreneurs usually start a business employing known technologies that operates in already established markets. Most companies founded by women, compared to those founded by men, use less capital, rely on existing technologies and focus on existing markets (Eurofund, 2019; Buble and Kružić, 2006). Furthermore, female entrepreneurs rarely achieve significant business expansion in the first years of their existence. This might be tied to the fact that sectors such as service and retail services are highly competitive, with limited opportunities for growth and profitability (Kalleberg and Leicht, 1991; Coleman, 2007). Most women entrepreneurs create five or fewer new jobs within a five-year period as the (GEM, 2023). The OECD report (2021) states that, between 2015 and 2019, new women entrepreneurs in OECD countries were only 60% as likely as men to anticipate creating at least 19 jobs over five years, suggesting a generally lower scale of job creation among women entrepreneurs.

Certain factors, such as the state of the national economy, the availability or absence of work opportunities, and societal and cultural constraints, may have an impact on the female entrepreneur's motives (Lingappa and Rodrigues, 2023). Some studies point out that there are some factors that motivate women entrepreneurs to participate in business activities, such as: family support and background, interests, education, work experience, self-satisfaction, to achieve ambitions, motivation, to change family fortunes, source of income etc. (Rahim et al., 2017). Female entrepreneurs are perceived to have higher emotional intelligence levels than their male counterparts (Singh and Kovid, 2023) enabling them to build better relationships with their employees. Furthermore, female entrepreneurs are perceived to understand and empathise with their employees, support their ambitions and show more interest in their development. Women leaders are more likely to engage in mentoring and employee development, investing more in the growth and training of their teams (Kark and Eagly, 2010).

Gupta et al. (2009) established that it is not biological distinctions between men and women, but rather the social construction of gender (masculinity and femininity) and entrepreneurship that affects the intention of engaging in entrepreneurship. A study published by the European

Commission reveals three categories of obstacles related to women in entrepreneurship were identified (Ferk, 2013): (1) Structural barriers: choice of education, traditional views and stereotypes about women, science and innovation; (2) Economic barriers: women are often perceived as less financially credible compared to men; (3) "Soft" barriers: lack of access to technical, scientific and general business networks, lack of business training, role models and entrepreneurial skills. Dewit et al. (2023) found that marriage/relationship perception has a key role in the career decisions of female entrepreneurs, additionally with the societal expectations to take care of traditional family responsibilities and to balance motherhood and career. Female entrepreneurs in Croatia encounter multiple challenges, frequently enhanced by an unequal societal structure that primarily designates caregiving responsibilities to women in the family and household (Katanec et al., 2024). Additionally, there are significant gender gaps when it comes to finding appropriate financing and funding (Pavlova & Gvetadze, 2023).

Kolaković (2006) believes that the challenges for women in entrepreneurship lie in overcoming societal discrimination against female entrepreneurs, which should be solved by government. Overcoming these challenges requires systemic changes and targeted initiatives that support and empower women in their entrepreneurial endeavours. Finally, the socio-cultural environment significantly impacts the legitimacy and acceptance of entrepreneurship within a region. The social legitimacy of entrepreneurship can influence individuals' intentions to start new ventures and their subsequent behaviours (Kibler et al., 2017). Successful role models and supportive networks can enhance the regional entrepreneurial climate, fostering a culture that values and encourages entrepreneurial activities (Havadi-Nagy & Tihamér-Tibor, 2016).

3. Women entrepreneurship in Croatia

The entrepreneurial activity of women is of crucial importance when it comes to the development of small and medium-sized enterprises, both in Croatia and worldwide. The Strategy for the Development of Women's Entrepreneurship in the Republic of Croatia (2014) contains research results that show the difference in the labour market when it comes to men and women. The underrepresentation of women at the managerial level coincides with their underrepresentation in the number of participants in the labour market, women enter managerial positions later and leave them earlier, which coincides with the later entry of women into the labour market and their earlier exit from it, regardless of the fact the percentage of highly qualified women in the labour market is higher than that of men and that the percentage of highly qualified women in the companies that participated in the study is higher than that of men, the situation in management bodies is reversed, the division of jobs at management level according to traditional gender roles coincides with the horizontal segregation of activities in the labour market. In addition, Croatia's participation in Global Entrepreneurship (GEM) research enables long-term monitoring of changes in women's entrepreneurial activity and international comparison, using a standardised research approach. GEM (Singer et al., 2024) shows that there is a clear difference between men and women in total early entrepreneurial activity (TEA men 16,4% vs. TEA women 9,9%, 2024). It was explained that this imbalance primarily stems from the (un)availability of services crucial for managing family life, which predominantly fall within the traditional responsibilities confided in women, such as childcare, domestic services, after-school programs, and elder care (Singer et al., 2024). GEM survey data suggested that there is no statistical difference between the number of the men and women who see a business opportunity in the next 6 months in the communities where they live (2020), nor is there a difference in motivation to start a business (Alpeza et al., 2022). The Finance Agency (FINA) has conducted a study on the share of female entrepreneurs in the ownership structure

of companies and provided some interesting results (FINA, 2024). The study indicates a modest increase in the number of female entrepreneurs, specifically female owners/founders, from 2019 to 2023, except for 2021, when the number of female entrepreneurs was 12.4% lower than in 2020. In 2023, data revealed that 31,689 enterprises, representing 21.4%, were solely owned by women, while an additional 13,588 companies were co-owned by women alongside males and/or legal entities, resulting in a total female entrepreneurship share of 30.5% among all companies. In the analysis of ownership distribution by sector, female entrepreneurs constitute 60.3% of the total entrepreneurs in the provision of other services (S), whilst male ownership accounts for 32.9%.

4. Study description

This paper explores existing knowledge about women in entrepreneurship and analyses the perceptions about them. The research was conducted using a questionnaire in which data on perceptions of women in entrepreneurship were collected from respondents and analysed using descriptive statistics, the Pearson chi-square test and the Mann-Whitney U-test. A survey with 95 respondents (56 women and 39 men) was conducted online over a three-week period in August 2024. The questionnaire for this research was developed based on the review of the relevant literature. This approach ensured that the questionnaire incorporated relevant motives and challenges stemmed from previous studies.

Of the 95 respondents, 56 were female (58.9%), while 39 respondents (41.1%) were male. The survey was mainly completed by people between the ages of 18 and 24 (48.4%). 20% of respondents were between 25 and 34 years old, 14.7% were between 35 and 44 years old, 7.4% were between 45 and 54 years old, while 9.5% of respondents were over 55 years old. As the survey was conducted on a random sample of people, the majority (47.4%) were students. 25.3% of respondents were employed, while 18.9% were unemployed and 8.4% were business owners. In terms of education level, the majority (36.8%) had completed secondary school. 27.4% of respondents had a undergraduate degree, 22.1% had a graduate degree, 7.4% had a Master of Science degree and 6.3% had a doctorate.

5. Results and discussion

Based on previous studies, the main reasons why women decide in favour of an entrepreneurial career were defined. The following motives were identified: inability to find employment (Caliendo and Kritikos, 2010; Haussen and Schegel, 2020), financial reasons (Kirkwood, 2009; Wassem, 2018, Kraja and Berberi, 2023), inability to get promotion (Pascher et al., 2015), desire to be their own boss (Ahmad et al., 2016), flexibility and freedom (Knorr et al., 2011; Tlaiss, 2015; Ahmad et al., 2016), pursuing their own ideas (Hussain and Hannon, 2008; Humbert and Roomi, 2018). This question examined the difference in perception between women and men in relation to the above motives and a Pearson chi-square was conducted. Statistically significant differences were found for several motives (Table 1). Significantly more women than men perceive the following motives for an entrepreneurial career: inability to get promotion (87.5% women vs. 64.1% men; p=0.007), the desire to be their own boss (98.2% women vs. 82.1% men; p=0.008), flexibility and freedom (92.5% women vs. 76.9% men; p=0.026), pursuing their own ideas (96.4% women vs. 79.5% men; p=0.014). In general, the most common motive is the desire to be their own boss (91.6%).

Table 1: Perception of motives of female entrepreneurs

Motives				Total	p
		Women	Men		
Inability to find employment	Yes	76,8%	59,0%	69,5%	,064
	No	23,2%	41,0%	30,5%	
Financial reasons	Yes	89,3%	79,5%	85,3%	,185
	No	10,7%	20,5%	14,7%	
Inability to get promotion	Yes	87,5%	64,1%	77,9%	**,007**
	No	12,5%	35,9%	22,1%	
Desire to be their own boss	Yes	98,2%	82,1%	91,6%	**,008**
	No	1,8%	17,9%	8,4%	
Flexibility and freedom	Yes	92,9%	76,9%	86,3%	**,026**
	No	7,1%	23,1%	13,7%	
Pursuing their own ideas	Yes	96,4%	79,5%	89,5%	**,014**
	No	3,6%	20,5%	10,5%	

Source: Authors

The most important challenges for female entrepreneurs were also defined on the basis of previous studies. The following challenges were identified: Gender inequality (Dewit et al., 2023; Katanec et al., 2024), social pressure (Noguera et al., 2013; Hanan, 2022), lack of self-confidence (Kay and Shipman, 2014), insufficient support from family and relatives (Welsh et al., 2021) and fear of failure (Cacciotti and Hayton, 2015; Mathur and Phillips, 2024). This question explored the difference in perceptions between women and men in relation to the above challenges and a Pearson Chi-Square was also conducted. Statistically significant differences were found for the following challenges (Table 2). Significantly more women than men perceive the following main challenges: gender inequality (92.9% women vs. 76.9% men; p=0.026) and fear of failure (92.9% women vs. 76.9% men; p=0.026). In general, the most frequently perceived challenge is social pressure (89.5%).

Table 2: Perception of challenges of female entrepreneurs

Challenges		Women	Men	Total	p
Gender inequality	Yes	92,9%	76,9%	86,3%	**,026**
	No	7,1%	23,1%	13,7%	
Social pressure	Yes	92,9%	84,6%	89,5%	,308
	No	7,1%	15,4%	10,5%	
Lack of self-confidence	Yes	92,9%	79,5%	87,4%	,066
	No	7,1%	20,5%	12,6%	
Insufficient support from family and relatives	Yes	80,4%	69,2%	75,8%	,213
	No	19,6%	30,8%	24,2%	
Fear of failure	Yes	92,9%	76,9%	86,3%	**,026**
	No	7,1%	23,1%	13,7%	

Source: Authors

Finally, the perceptions of men and women about female entrepreneurs were analysed. The Mann-Whitney U-test was used to analyse whether there were statistically significant differences between the perceptions of the two groups of respondents. Statistically significant differences were found for three statements (Table 3).

Men believe that men are better suited to management positions than women. They gave this statement an average score of 3.33, while the average score of female respondents was 2.07. A statistically significant difference was found ($p<0.001$). In addition, men believe that women are guided by emotions in management. They gave an average score of 4.51, while women rated this at 3.96 ($p=0.014$). Finally, men were less likely to agree with the statement that women bring more innovative and creative products and services to the market (mean score of 3.90), while women gave this statement a high score of 4.48 ($p=0.034$).

Table 3: Perceptions about female entrepreneurs

		Mean	**p**
Women entrepreneurs are more committed than men.	Women	4,41	*0,415*
	Men	4,10	
Women entrepreneurs are at a disadvantage compared to men.	Women	4,46	*0,788*
	Men	4,31	
Men are better suited to management positions than women.	Women	2,07	***<0,001***
	Men	3,33	
Women are led by emotions when it comes to management.	Women	3,96	***0,014***
	Men	4,51	
Women are trying to solve some social problems and improve communities through entrepreneurship.	Women	4,39	*0,094*
	Men	3,95	
Women bring more innovative and creative products and services to the market.	Women	4,48	***0,034***
	Men	3,90	
Women manage business finances better.	Women	4,43	*0,113*
	Men	3,82	
Women entrepreneurs tend to work more in teams than men.	Women	4,36	*0,699*
	Men	4,36	
Women cope better in uncertain and dynamic environments.	Women	4,23	*0,756*
	Men	3,92	
Women face more obstacles than men when starting and running a business.	Women	4,61	*0,902*
	Men	4,39	

Source: Authors

In conclusion, this study sheds light on the complex interplay of motivations, challenges, and perceptions that shape the experiences of women entrepreneurs. The statistically significant differences between male and female respondents underscore the need for a deeper understanding of these dynamics to foster a more inclusive entrepreneurial ecosystem. Addressing the systemic barriers and biases that women face is critical to promoting gender equity in entrepreneurship. Furthermore, encouraging a shift in societal perceptions regarding women's capabilities in management and innovation can pave the way for more women to pursue entrepreneurial endeavours confidently. Future research should continue to explore these themes, focusing on actionable strategies that can support women in overcoming challenges and achieving their entrepreneurial goals.

6. Conclusion

Women are still struggling with the stereotypes that prevail in our society, both in the world and in Croatia. They represent a sensitive group in the labour market and it is necessary to understand their specific context. Considering the fact that they differ from men in the way they work, their characteristics and skills, they have actually achieved better results in various fields. Women, unlike men, are not out for profit but are more concerned about creating a pleasant and friendly atmosphere between employees and constantly involving them in the most important decisions, i.e. they want to achieve a common goal. Employees feel more comfortable when their manager is a woman. Unfortunately, they still face many obstacles and challenges due to entrenched stereotypes and a traditional view of the business world. It is difficult for women to obtain funding because they are considered less financially strong, but many studies have proven that they are more cautious and careful than men when it comes to money. Furthermore, due to the perception that a woman's main role is to take care of children and family, it is difficult for them to balance their personal and business lives, so they often lose their jobs or quit voluntarily.

Our survey revealed interesting results. As expected, most respondents agreed that social pressure, gender inequality, fear of failure, lack of environmental support and lack of self-confidence discourage women from entering the world of entrepreneurship. The vast majority also agreed that the reasons that motivate women to enter the world of entrepreneurship are financial reasons, the impossibility of finding a job, flexibility and freedom, realising their own ideas, the impossibility of progressing in their career and the desire to be their own boss. For these reasons, women need to create a pleasant and positive environment in which they can achieve their goals. In the survey, respondents pointed out that they agreed with some statements, e.g. that women are more committed than men, that they are in a worse position, that they are more likely to work in teams, but also that they encounter more barriers and obstacles than men. The vast majority of respondents also agree that women cope better in dynamic and uncertain environments, that they manage company finances better, that they bring more innovative and creative products and services to the market and that they show more emotion in their leadership role.

To sum up, female entrepreneurship in Croatia is a multifaceted phenomenon shaped by historical, cultural, and economic factors. While there has been progress in increasing the number of women entrepreneurs, significant challenges remain, particularly regarding access to finance, support systems, and societal norms. Future research should continue to explore the diverse experiences of women entrepreneurs in Croatia, with a focus on intersectionality and the effectiveness of policy interventions. By addressing these issues, stakeholders can create a more conducive environment for female entrepreneurship, ultimately contributing to economic growth and gender equality in Croatia.

REFERENCES

Ahmad, R., Bakri, N., & Baharun, R. (2016): ***Motivational factors of women entrepreneurship in Malaysia***. Sci. Int.(Lahore), 28(2), 1849-1858.

Alpeza, M., Basarac Sertić, M., Delić, A., Has, M., Koprivnjak Popović, T., Križanović, K., Kuček, S., Mezulić Jurić, P., Novosel, M., Oberman, M., Oberman Peterka, S., Perić, J., Petričević, J., Šimić Banović, R., Vučković, V. (2022). Izvješće o malim i srednjim poduzećima u Hrvatskoj – 2021.: ***Mala i srednja poduzeća u Hrvatskoj u uvjetima pandemije bolesti***

COVID-19. Available at: https://www.cepor.hr/wp-content/uploads/2015/03/CEPOR-Mala-i-srednja-poduze%C4%87a-u-HR-u-vrijeme-pandemije-COVID-19.pdf [accessed 30.4.2025.]

Bruni, A., Gherardi, S. and Poggio, B. (2004b): ***Doing gender, doing entrepreneurship: an ethnographic account of intertwined practices.*** Gender, Work and Organisation, 11: 406–429.

Brush, C. G., De Bruin, A., & Welter, F. (2009): ***A gender-aware framework for women's entrepreneurship.*** International Journal of Gender and entrepreneurship, 1(1), 8-24.

Brush, C., Edelman, L. F., Manolova, T., & Welter, F. (2019): ***A gendered look at entrepreneurship ecosystems***. Small Business Economics, 53, 393-408.

Buble, M., Kružić, D. (2006): ***Poduzetništvo-realnost sadašnjosti i izazov budućnosti***, Split

Bujan Katanec, I., Gača, M., & Magdalenić, D. (2024): ***Discrimination perception in female Entrepreneurship***. Obrazovanje za poduzetništvo-E4E: znanstveno stručni časopis o obrazovanju za poduzetništvo, 14(2), 21-32.

Cacciotti, G., & Hayton, J. C. (2015): ***Fear and entrepreneurship: A review and research agenda.*** International Journal of Management Reviews, 17(2), 165-190.

Caliendo, M., & Kritikos, A. S. (2010): ***Start-ups by the unemployed: characteristics, survival and direct employment effects***. Small Business Economics, 35(1), 71-92.

Coleman, S. (2007): ***The role of human and financial capital in the profitability and growth of women owned firms***. Journal of Small Management, 45(3): 303–319.
Compagno, C., Ciroi, A., & Pittino, D. (2024): ***A Theoretical Exploration of Gender Dynamics in Entrepreneurship***. Università degli studi di Udine, Dipartimento di scienze economiche e statistiche. *Working paper*

De Bruin, A, Brush, C. and Welter, F. (2006): ***Introduction to the Special Issue: Towards Building Cumulative Knowledge on Women's Entrepreneurship***. Entrepreneurship, Theory and Practice, 30(5): 585–593.

De Vita, L., Mari, M., & Poggesi, S. (2014): ***Women entrepreneurs in and from developing countries: Evidences from the literature***. European Management Journal, *32*(3), 451-460.

Dewitt, S., Jafari-Sadeghi, V., Sukumar, A., Aruvanahalli Nagaraju, R., Sadraei, R., & Li, F. (2023): ***Family dynamics and relationships in female entrepreneurship: An exploratory study***. Journal of Family Business Management, *13*(3), 626-644.

Eurofound (2019): ***Female entrepreneurship: Public and private funding***, Publications Office of the European Union, Luxembourg.

Ferk, M. (2013): ***Boosting women entrepreneurship in Western Balkan countries-critical analysis and best practices***. Učenje za poduzetništvo, 3(1), 49-56.

FINA (2024): ***Udio žena poduzetnica u vlasničkoj strukturi trgovačkih društava***. Available at: https://www.fina.hr/ngsite/content/download/15525/244149/1 [accessed 30.4.2025.]

Galić, B. (2011): ***Žene i rad u suvremenom društvu-značaj orodnjenog rada***. Available at: https://hrcak.srce.hr/file/106713 [accessed 30.4.2025.]

GEM (Global Entrepreneurship Monitor) (2023): ***Global Entrepreneurship Monitor 2022/23 Women's Entrepreneurship Report***. Available at: https://www.gemconsortium.org/reports/womens-entrepreneurship [accessed 30.4.2025.]

Gupta, V. K., Turban, D. B., Wasti, S. A., & Sikdar, A. (2009): ***The role of gender stereotypes in perceptions of entrepreneurs and intentions to become an entrepreneur***. Entrepreneurship theory and practice, *33*(2), 397-417.

Hanan, K. (2022): ***Socio-cultural barriers to female entrepreneurship in rural areas. Journal of Economics,*** Finance and Management (JEFM), 1(1), 103-116.

Haussen, T., & Schlegel, M. (2020): ***Unemployment reduction through solo self-employment: A gender question?*** Empirical Economics, 59(6), 3085-3105.

Havadi-Nagy, K. & Tihamér-Tibor, S. (2016): ***Entrepreneurship and activation of local potential for rural development. lemnia and sâncraiu – two case studies from Romania***. Territorial Identity and Development, (1), 7-22. https://doi.org/10.23740/tid120161

Heliman, M.E. and Chen, J.J. (2003): ***Entrepreneurship as a solution: The allure of selfemployment for women and minorities***. Human Resource Management Review, 13: 347–365.

Humbert, A. L., & Roomi, M. A. (2018): ***Prone to "care"? Relating motivations to economic and social performance among women social entrepreneurs in Europe***. Social Enterprise Journal, 14(3), 312-327.

Hussain, J. G., Scott, J. M., & Hannon, P. D. (2008): ***The new generation: characteristics and motivations of BME graduate entrepreneurs***. Education+ Training, 50(7), 582-596.

Kalleberg, A.L. and Leicht, K.T. (1991): ***Gender and organizational performance: determinants of small business and success***. Academy of Management Journal, 34(1): 136–161.

Kark, R., Eagly, A. H. (2010): ***Gender and leadership: Negotiating the labyrinth***. In J. C. Chrisler & D. R. McCreary (Eds.), Handbook of Gender Research in Psychology (pp. 443-468). Springer.

Kay, K., & Shipman, C. (2014): ***The confidence gap***. The Atlantic, 14(1), 1-18.

Kibler, E., Kautonen, T., & Fink, M. (2017): ***Regional social legitimacy of entrepreneurship: implications for entrepreneurial intention and start-up behaviour***. Entrepreneurship in a Regional Context, 57-77. https://doi.org/10.4324/9781315691985-4

Kirkwood, J. (2009): ***Motivational factors in a push-pull theory of entrepreneurship***. Gender in management: An international journal, 24(5), 346-364.

Knorr, H., Garzón, D., & Martínez, D. (2011): ***Motivations and differences upon reconciling professional and personal life: an empirical study of businesswomen and businessmen in the Valencian Community***. International Entrepreneurship and Management Journal, 7, 391-412.

Kolaković, M. (2006): ***Poduzetništvo u ekonomiji znanja***, Sinergija nakladništvo, Zagreb

Kraja, Y. B., & Berberi, A. (2023): ***Female entrepreneurs and motivational factors.*** International Journal of Professional Business Review: Int. J. Prof. Bus. Rev., 8(5), 10.

Laguía, A., García-Ael, C., Wach, D., & Moriano, J. A. (2019): ***"Think entrepreneur-think male": a task and relationship scale to measure gender stereotypes in entrepreneurship.*** International Entrepreneurship and Management Journal, 15, 749-772.

Lingappa, A. K., & Rodrigues, L. L. (2023): ***Synthesis of necessity and opportunity motivation factors in women entrepreneurship: A systematic literature review***. *Sage Open*, 13(1), 21582440231159294.

Marlow, S., Carter, S., Shaw, E. (2008): ***Constructing female entrepreneurship policy in the UK: is the US a relevant benchmark?*** Environment and Planning C: Government and Policy, 26: 335–351.

Marlow, S., McAdam, M. (2013): ***Gender and entrepreneurship: Advancing debate and challenging myths; exploring the mystery of the under-performing female entrepreneur***. International Journal of Entrepreneurial Behavior & Research, 19(1), 114-124.

Martínez-Rodríguez, I., Quintana-Rojo, C., Gento, P., & Callejas-Albinana, F. E. (2022): ***Public policy recommendations for promoting female entrepreneurship in Europe***. International Entrepreneurship and Management Journal, 18(3), 1235-1262.

Mathur, S., & Phillips, R. A. (2024): ***The influence of the fear of failure on women pursuing entrepreneurship in the United Kingdom***. Journal of the International Council for Small Business, 6(1), 66–75. https://doi.org/10.1080/26437015.2024.2393664

Minniti, M. (2009): ***Gender issues in entrepreneurship***. Foundations and Trends® in Entrepreneurship, 5(7–8), 497-621.

Minniti, M., & Naudé, W. (2010): ***What do we know about the patterns and determinants of female entrepreneurship across countries?*** The European Journal of Development Research, 22, 277-293.

Noguera, M., Alvarez, C. & Urbano, D.: ***Socio-cultural factors and female entrepreneurship***. Int Entrep Manag J 9, 183–197 (2013). https://doi.org/10.1007/s11365-013-0251-x

OECD (2021): ***Entrepreneurship Policies through a Gender Lens, OECD Studies on SMEs and Entrepreneurship***, OECD Publishing, Paris, https://doi.org/10.1787/71c8f9c9-en.

Pascher, U., Roski, M., & Halbfas, B. (2015): ***Entrepreneurial aspirations and start-up motives of women chemists in Germany***. International Journal of Gender and Entrepreneurship, 7(3), 272-290.

Pavlova, E., & Gvetadze, S. (2023): ***Female access to finance: a survey of literature***. European Investment Fund.

Rahim, I. H. A., Fabeil, N. F., & Sung, T. P. (2017): ***Motivator and challenges of women entrepreneurs***. Journal of Global Business and Social Entrepreneurship, *1*(3), 111-121.

Shabbir, A., di Gregorio, S. (1996): ***An examination of the relationship between women's personal goals and structural factors influencing their decision to start a business: the case of Pakistan***. Journal of Business Venturing, 11(6): 507–529.

Singer, S., Šarlija, N., Pfeifer, S., Oberman Peterka, S. (2021): ***Što čini Hrvatsku (ne)poduzetničkom zemljom?*** CEPOR – Centar za politiku razvoja malih i srednjih poduzeća i poduzetništva. Available at: https://www.cepor.hr/wp-content/uploads/2015/03/WEB-GEM-2019I20.pdf [accessed 30.4.2025.]

Singer, S., Šarlija, N., Pfeifer, S., Oberman Peterka, S. (2024): ***Što čini Hrvatsku (ne)poduzetničkom zemljom?*** CEPOR – Centar za politiku razvoja malih i srednjih poduzeća i poduzetništva. Available at: https://www.cepor.hr/GEM-2023.pdf [accessed 30.4.2025.]

Singh, N., & Kovid, R. K. (2023): ***Women Entrepreneur's Emotional Intelligence and Firm Performance: Mediating Role of Networking Competencies***. FIIB Business Review, 0(0). https://doi.org/10.1177/23197145231184307

The Strategy for the Development of Women's Entrepreneurship in the Republic of Croatia (2014) Available at: https://mingo.gov.hr/UserDocsImages/GLAVNO%20TAJNI%C5%A0TVO/Strategija,%20planovi%20i%20ostali%20dokumenti/Strategija_razvoja_poduzetni%C5%A1tva_zena_RH12117.pdf [accessed 30.4.2025.]

Tlaiss, H. A. (2015): ***Entrepreneurial motivations of women: Evidence from the United Arab Emirates***. International Small Business Journal, 33(5), 562-581.

Vrdoljak Raguž, I. (2020): ***Women entrepreneurship in the Republic of Croatia***. In DIEM: Dubrovnik International Economic Meeting (Vol. 5, No. 1, pp. 143-150). Sveučilište u Dubrovniku.

Wassem, A. (2018): ***Female Necessity and Opportunity Entrepreneruship: A Studiy of Income Level and Social Profess***. Pakistan Journal of Women's Studies, 25(1), 127-149.

Welsh, D. H., Kaciak, E., Mehtap, S., Pellegrini, M. M., Caputo, A., & Ahmed, S. (2021): ***The door swings in and out: The impact of family support and country stability on success of women entrepreneurs in the Arab world***. International Small Business Journal, 39(7), 619-642.

A scientific paper

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HISTORICAL ROOTS OF SUSTAINABLE ENTREPRENEURSHIP: AN ANALYSIS OF ADVERTISING STRATEGIES IN GERMAN-LANGUAGE NEWSPAPERS PRINTED IN OSIJEK AT THE END OF THE 19TH AND THE BEGINNING OF THE 20TH CENTURY

ABSTRACT

This paper explores the historical roots of sustainable entrepreneurship by analysing advertising strategies in local German-language newspapers printed in Osijek at the end of the 19th and the beginning of the 20th century, comparing them with contemporary sustainable entrepreneurial ecosystems. The focus is on how historical advertisements reflect values such as inclusivity, cultural sustainability, social cohesion, and cooperation and how these values are transferred into modern business models. The role of local newspapers in shaping the social and economic identity of Osijek demonstrates that advertising strategies were not merely tools for product promotion but also means of strengthening social ties and cultural awareness.
This study aims to identify key parallels between historical and contemporary entrepreneurial practices, particularly emphasizing the cultural and social aspects that have shaped local businesses. Historical advertising strategies are analysed in terms of their contribution to the development of local industries and their ability to foster collaboration among different social groups.
The methods used in this research include archival analysis of historical newspapers from Osijek (e.g., Die Drau and Slavonische Presse), qualitative content analysis of historical advertisements, and a comparative case study linking historical and contemporary approaches to sustainable entrepreneurship. Special emphasis is placed on advertisements' linguistic strategies promoting local industry and social cohesion.
The results indicate that historical advertising strategies played a crucial role in shaping local identity, encouraging cooperation among different social groups, and strengthening cultural sustainability. Contemporary entrepreneurial ecosystems continue to develop these values through innovative models that integrate local resources with global trends. The historical analysis provides valuable insight into the continuity of values that connect the past and the present.

Key words: *historical advertising strategies, German-language newspapers in Osijek, sustainable development, cultural sustainability, social cohesion.*

1. Introduction and Methods

Old newspapers, especially those printed in local contexts and in small editions, document not only international but also regional and local history, politics, culture, and social issues. They also provide insights into the commercial purpose of advertisements, which were an integral part of them. Despite this, advertisements published in German-language newspapers in Osijek remain an under-researched field, primarily because they could only be accessed by retrieving them from their source—the newspapers themselves. The lack of research on such material is often due to accessibility issues, such as the physical condition of the documents, archival or library policies, and other preservation concerns. While the 19th century was the golden age of newspapers, the 21st century has brought digitization and increased accessibility to these historical publications. Digitization enables a comprehensive and complete view of their content. Virtual reading rooms have become a new digital format for reading and searching historical newspapers and magazines online.

This study examines advertisements published in old German-language newspapers printed in Osijek in the 19th and 20th centuries (*Slavonische Presse* and *Die Drau*), analyzing their content using digitized publications available on the websites of DiFMOE (Das Digitale Forum Mittel- und Osteuropa / Digital Forum of Central and Eastern Europe) and the Museum of Slavonia[1]. Another advantage of digitization is the ability to supplement missing issues or sections of newspapers by rescanning copies from other institutions, virtually reconstructing or completing entire collections of editions[2].

2. Historical Context

Despite the rich history of German-language newspaper printing in present-day Croatia, it is essential to recognize that numerous political, geographical, and economic factors determined their emergence in different regions. Fruk (2005, 393) distinguishes three chronological and thematic phases of German-language journalism in Croatia.[3] In Zagreb, for example, *Luna, Agramer Zeitschrift*[4] was established as early as 1828, followed by the better-known *Agramer Zeitung* in 1848. Alongside other German-language newspapers in Zagreb, such as *Croatia* (1839–1842), *Der Pilger* (published in Karlovac from 1841 to 1847) completed the northern Croatian circle of German-language publications (Dukić, 2015, 149). Osijek, however, had to wait nearly 40 years[5] for the publication of its first newspaper, *Esseker Lokalblatt und*

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[1] Osijek newspapers in the German language, https://novine.mso.hr/

[2] ANNO Historische Zeitungen und Zeitschriften, https://anno.onb.ac.at/node/15

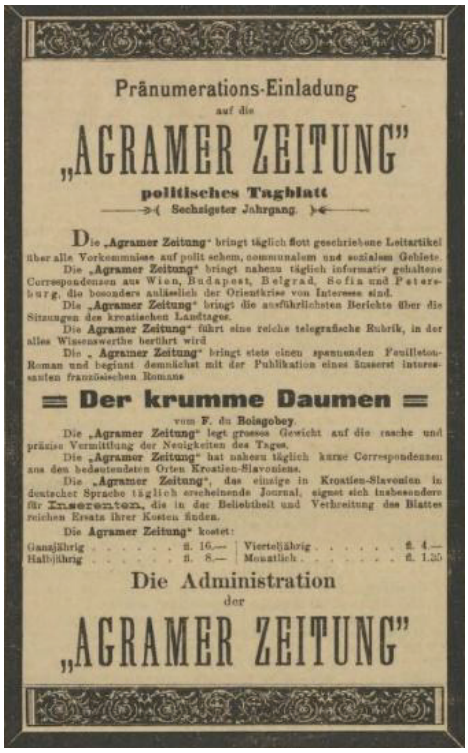
[3] The initial phase (1786–1848) was marked by newspapers or magazines printed mainly in Zagreb. In the second phase (1848–1918), newspapers began to be published in other Croatian cities as well. The third phase (1918–1941) saw the coexistence of newspapers in both Croatian and German, sometimes in bilingual editions. However, by the late 1930s, most party-affiliated newspapers were promoting the policies of the Third Reich, such as *Slavonischer Volksbote*, the main informational and political weekly of the German minority, published in Osijek from 1936 to 1944.

[4] In 1830, the newspaper changed its name to *Agramer politische Zeitung*, while *Luna* became an entertainment and literary supplement, and both continued to be published until 1912. (Hrvatska enciklopedija/Croatian Encyclopedia, online edition)

[5] In 1835, Alojzije Martin Divald attempted to publish *Tjednik o Osijeku i za Osijek*, a newspaper in German (*Wochenblatt von und für Essek*) intended to feature economic articles. However, his request was denied on the grounds that "the applicant's property was not sufficient security for subscribers" (Malbaša, 1978, 25, as cited in Glušac, 2013, 150). Nevertheless, in 1848, Divald began printing *Der Volksredner für Vaterland Freiheit und Gesetz*, the first local newspaper.

Landbote[6] (Obad, 2007, 115), despite historical similarities between Croatia and Slavonia in terms of their long-standing affiliation with the Hungarian-Croatian Kingdom and the use of German as a language of culture and communication (Dukić, 2015, 159). Later, several German-language newspapers appeared in Osijek's public sphere, including *Die Drau* (1869–1938), *Esseker Allgemeine Illustrierte Zeitung* (1896)[7], and *Slavonische Presse* (1885–1929)[8].

Photograph 1: Advertisement for *Agramer Zeitung* in *Slavonische Presse*, December 17, 1885, Issue No. 34.



Pränumerations-Einladung

auf die

„AGRAMER ZEITUNG"

politisches Tagblatt

Sechsigster Jahrgang

Die „Agramer Zeitung" bringt täglich flott geschriebene Leitartikel über alle Vorkommnisse auf politischem, communalem und sozialem Gebiete.

Die „Agramer Zeitung" bringt nahezu täglich informativ gehaltene Correspondenzen aus Wien, Budapest, Belgrad, Sofia und Petersburg, die besonders anlässlich der Orientkrise von Interesse sind.

Die „Agramer Zeitung" bringt die ausführlichsten Berichte über die Sitzungen des kroatischen Landtages.

Die „Agramer Zeitung" führt eine reiche telegrafische Rubrik, in der alles Wissenswerthe berührt wird.

Die „Agramer Zeitung" bringt stets einen spannenden Feuilleton-Roman und beginnt demnächst mit der Publikation eines äusserst interessanten französischen Romans

Der krumme Daumen

vom F. du Boisgobey.

Die „Agramer Zeitung" legt grosses Gewicht auf die rasche und präzise Vermittlung der Neuigkeiten des Tages.

Die „Agramer Zeitung" hat nahezu täglich kurze Correspondenzen aus den bedeutendsten Orten Kroatien-Slavoniens.

Die „Agramer Zeitung", das einzige in Kroatien-Slavonien in deutscher Sprache täglich erscheinende Journal, eignet sich insbesondere für Inserenten, die in der Beliebtheit und Verbreitung des Blattes reichen Ersatz ihrer Kosten finden.

Die „Agramer Zeitung" kostet:

Ganzjährig	fl. 16.—	Vierteljährig	fl. 4.—
Halbjährig	fl. 8.—	Monatlich	fl. 1.35

Die Administration

der

„AGRAMER ZEITUNG"

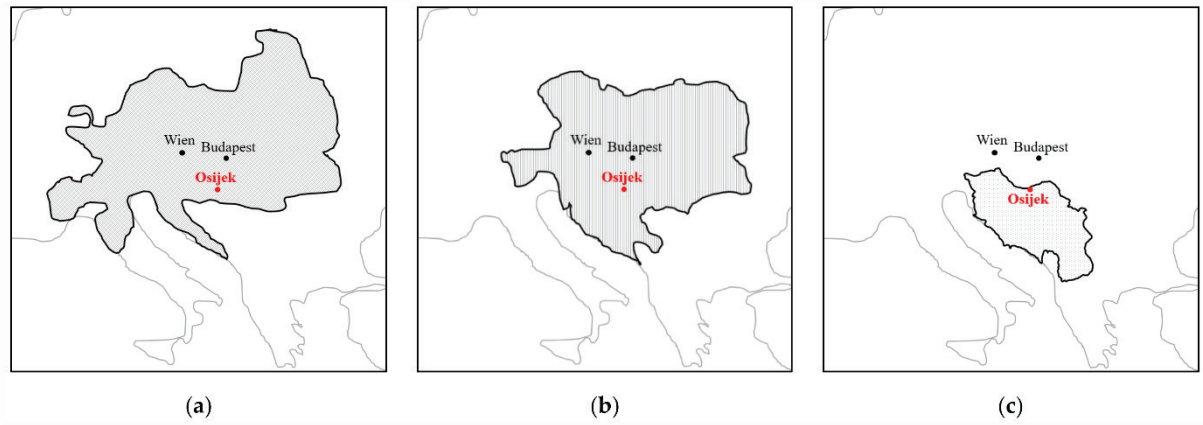
Source: https://www.difmoe.eu/view/uuid:17989dec-598a-402e-ae95-ab1eeb989b26?page=uuid:fbb8a1af-a388-4481-8a1d-eeb2372762b6

[6] In 1835, Alojzije Martin Divald attempted to publish *Tjednik o Osijeku i za Osijek*, a newspaper in German (*Wochenblatt von und für Essek*) intended to feature economic articles. However, his request was denied on the grounds that "the applicant's property was not sufficient security for subscribers" (Malbaša, 1978, 25, as cited in Glušac, 2013, 150). Nevertheless, in 1848, Divald began printing *Der Volksredner für Vaterland Freiheit und Gesetz*, the first local newspaper, which was published for nearly five years.

[7] The first illustrated newspaper in Croatia in the German language was published in 1869 in Osijek, printed by Dragutin Lehmann's press. Modelled after similar German newspapers, it introduced illustrated publications to the local printing scene. (Old Croatian Newspapers: Portal of Digitized Newspapers).

[8] It was published three times a week until 1893, when it became a daily newspaper. Between 1923 and 1927, it was not printed, and publication ceased entirely in 1929. The publisher, owner, and editor-in-chief was Karl (Carl) Laubner.

Figure 1: Osijek as a part of different countries: (a) Habsburg Monarchy (since 1687); (b) Austrian–Hungarian Monarchy (1867–1918); (c) The Kingdom of Serbs, Croats and Slovenes (1918–1929) and later the Kingdom of Yugoslavia (1929–1945).



Source: Kraus, L., Bojanić Obad Šćitaroci, B., Karač, Z., & Kraus, I. (2022). Disappearance and Sustainability of Historical Industrial Areas in Osijek (Croatia): Three Case Studies

The city of Osijek (Figure 1) became the seat of Virovitica County at that time, adopting the appearance of a modern European city. According to the census from the end of 1857, the city had a population of 14,344 (Matić, 2024). Penava Brekalo (2022, 150) highlights that in the second half of the nineteenth and early twentieth centuries, Osijek was the second-largest city in Croatia regarding demographic indicators and economic potential. During this period, several highly reputable factories were established, including a brewery and match factory, a leather factory, a gasworks, a furniture factory, a flax factory, a sugar factory, a chocolate factory, a soap factory, a biscuit factory, and others. A more detailed numerical overview provides a clearer picture of the situation at the time. At the end of the 19th century, small and medium-sized factories began operating in Osijek alongside many artisans and manufacturers. According to the 1890 census, Osijek had five factories employing 235 workers. By 1900, the number had grown to 14 factories with 697 workers; by 1910, 25 factories employed 2,057 workers. Notably, in 1910, Osijek had a population of approximately 33,300 (Kraus et al., 2022). In this important cultural and economic center of Slavonia, the German community made up nearly half of the city's population.[9] This demographic reality enabled the German community to play a significant role in all aspects of urban life, including newspaper publishing (Table 1). Fruk (1997) describes Osijek as a focal point for German-language printing activities in this context.

[9] Obad (2007, 116) refers to statistical data indicating that by the end of the 19th century (1880), Osijek had *8,970 residents* who declared German as their mother tongue, alongside *7,482 Croats and Serbs, 1,152 Hungarians, 275 Czechs, 125 Slovenes, 78 Italians, 52 Slovaks, 23 Poles, and 20 Bulgarians*…. At the turn of the century, the situation changed significantly: the city had *12,000 residents* who declared German as their mother tongue and *6,500 Croats*.

Table 1: Population of Osijek and Ethnic Composition

YEAR	Croats	Germans	Hungarians	Srbs	Jews	Others	Total
1890.	7.482	8.970	1.152		1.493		**19.809**
1900.	7.586	13.503	2.873	1.796	2.094	579	**26.769**
1910.	12.808	12.381	4.306	2.450	2.340	759	**33.337**

Source: Červenjak and Živaković-Kerže (2014, 130): Modernizacijska kretanja i položaj žena u gradu Osijeku na prijelazu 19. u 20. stoljeće

3. Newspapers in German printed in Osijek in the 19th and 20th centuries.

The German newspapers published in Osijek varied in content, frequency of publication, and duration. However, they all were directed toward the local community and were important in promoting local interests. The newspapers published various types of content, ranging from news and political commentary to cultural and economic topics. Therefore, it is not surprising that scholarly interest in studying newspapers in the German language printed in Osijek is mainly focused on researching their content in terms of political orientation, economic topics, and literary texts (Fruk, M. 1997; Obad, 2007; Vinaj, 2003 and 2007; Glušac, 2013; Erl Šafar et al., 2022, etc.). Although advertisements were present in all the aforementioned publications and mainly occupied a significant portion of space, they are far less represented in contemporary research segments.[10] Fatović-Ferenčić and Ferber Bogdan (2018, 50) state that "the shaping of the consumer market during the second half of the 19th century influenced the development of the modern marketing system, which encouraged the emergence of consumer advertising (cosmetic lines, toothpaste, clothing, etc.). The development of the economy and industry at the end of the 19th century influenced the thinking and development of advertising (…). This process is also visible in our areas." Stolac (2017) shares the same view, emphasizing that the leading media for communication were printed: besides posters, newspaper advertising was indispensable.

[10] One of the reasons lies in the fact that a large part of the corpus was written in Gothic script.

Photograph 2: Advertisement for Feller's products from *Slavonische Presse* July 4, 1920, No. 147

Source: https://www.difmoe.eu/view/uuid:45ce9142-1158-47e6-9e68-7fa970bd182f?page=uuid:66dc5ffe-fe00-431e-80f2-646ec25a5c6f

In this context, it is essential to highlight the work of the Feller family, particularly Miroslav Feller, as an indispensable figure in the development of advertising communication in Croatia. His contribution to the theory and practice of "what is referred to in different contexts as Croatian advertising, market communication, or the 'art of persuasion'" is emphasized by Štuka (2022) in the preface to the recent translation of Feller's book *Psychodynamics of Advertising* from 1932. Miroslav Feller (1901–1961) was the son of the esteemed pharmacist and factory owner Eugene Viktor (1871–1936), a Ukrainian by birth, who pioneered marketing strategies in advertising his pharmacy's specialty brand, Elsa (Photograph 2). While his brother Ferdinand introduced the concept of collective pharmaceutical propaganda into pharmaceutical marketing, Miroslav, through the establishment and development of the advertising agency *Imago*, became one of the leading figures in the institutionalization and professionalization of commercial graphic design (Fatović-Ferenčić & Ferber Bogdan, 2018, 49).

Recent studies on advertisements in German-language newspapers printed in Osijek have emerged from the project *Spuren deutscher Sprache, Literatur und Kultur in Kroatien*, which involved around 30 Croatian and German scholars, as well as several Croatian institutions, including the National and University Library in Zagreb, the newspaper archive of the Museum of Slavonia in Osijek, and the State Archive in Osijek. The research is primarily philological in orientation. For example, Šarić Šokčević and Jozić (2022) emphasize that "advertisements (…) are fertile ground for textual-linguistic research, as they contain the marketing activity of their time, the languages used in their creation, and ultimately function as a reflection of the era." Similarly, an analysis of bilingual advertisements in the Osijek-based German-language newspaper *Slavonische Presse* from a text-linguistic perspective demonstrates that these advertisements reflect the status of the German language (Berkec & Šarić Šokčević, 2020).

The Museum of Slavonia in Osijek showcased its exhibition *Ah, Those Household Chores*[11] with a catalog (2009) highlighting that *Esseker Lokalblatt und Landbote, Esseker Zeitung, Die Drau,* and *Slavonische Presse* initially featured advertisements for Viennese shops, factories, and banks. However, local businesses soon began advertising within the same framework, promoting their products and services—primarily in both German and Croatian.[12]

Advertising strategies in Osijek's German newspapers were tailored to the local market and incorporated cultural symbols recognizable to the local community. As such, they played a crucial role in building credibility and attracting consumers, which was key to the success of local businesses. While the creators of advertisements in old newspapers often remained anonymous, their work—thanks to the skill and available technology of the time—represented actual small-scale artistic achievements.

During the Art Nouveau period, advertisements were particularly striking and visually distinctive. Advertising combined aesthetically appealing illustrations with carefully crafted messages, encouraging both men and women in Osijek to consume, following the advertising strategies of contemporary European cities.

4. Past vs. Present

Further research is needed on the importance of advertising strategies in old newspapers and their impact on local communities. Since similar trends are now being promoted in sustainable and resilient entrepreneurial ecosystems, a parallel between seemingly incompatible and temporally (very) distant strategies can be drawn.

Reflections on the sustainability and resilience of entrepreneurial ecosystems began to develop more intensively in the early 21st century, particularly in response to global challenges such as climate change, rising economic inequality, and rapid technological transformations. The topic has become increasingly relevant in efforts to support the long-term sustainability of entrepreneurial initiatives. Cohen (2006) was among the first to theoretically shape the concept of a sustainable entrepreneurial ecosystem, emphasizing the interconnectedness of environmental, social, and economic factors. From the mid-2000s onward, sustainable entrepreneurial ecosystems have received growing attention, especially within the academic community. Research has focused on the role of institutions such as universities and governments in fostering sustainable entrepreneurial practices. In recent years, there has been an increasing number of systematic literature reviews (Chaudhary, S. et al., 2023) analysing how sustainable ecosystems are developed and maintained. These studies highlight the importance of collaboration and interconnectivity among various stakeholders in creating a resilient and sustainable entrepreneurial environment. Concepts of sustainability and resilience in entrepreneurship increasingly emerge as responses to contemporary global challenges and the need for long-term sustainable development.

In line with the above, there are several ways in which business practices in Osijek from the late 19th and early 20th centuries[13], as reflected in advertisements published in local German-

[11] Museum of Slavonia Osijek, December 2009 – April 2010.
Exhibition and catalogue authors: Ksenija Katalinić, Radmila Biondić, Marina Vinaj.

[12] Advertising campaigns in Osijek were targeted at the local merchant and artisan population, while those in Vienna were more sophisticated, aimed at a broader urban audience, and utilized more advanced printing techniques.

[13] For the purposes of this study, digitized publications from the DiFMOE website were used. This platform offers a range of historical newspapers from multiethnic cultural regions of Eastern Europe, particularly those with a historically significant German-speaking population https://www.difmoe.info/projekte/deutschsprachige-zeitungen-in-kroatien/

language newspapers, can be connected to contemporary considerations of sustainable and resilient entrepreneurial ecosystems.[14]

4.1. Cultural and Social Context

Advertisements in local newspapers[15] reflected and shaped the cultural and social values of Osijek and the broader community. *Slavonische Presse* and *Die Drau* used German as a prestigious language associated with the upper social classes in Osijek, reflecting the cultural and social hierarchy of that time (Berkec & Šarić Šokčević, 2020). The Gothic script was used for many years. At the same time, advertisements were often bilingual (German-Croatian) or even trilingual, highlighting Osijek's multicultural character. This advertising strategy indicates that the target audiences of local newspapers belonged to different ethnic communities in the city and surrounding areas (Šarić Šokčević & Jozić, 2022). Furthermore, newspapers published subscription calls for their issues (Photograph 3) and for other newspapers, such as the *Agramer Zeitung* from Zagreb, *Wiener Zeitung* from Vienna, and *Die Gartenlaube* from Germany (Photograph 4).

In the history of print media, advertising, and subscription promotions for other publications had both cultural and economic significance. Advertisements were a key source of revenue, enabling newspapers and other publications to reach a wider audience. The colportage system, the contemporary distribution method, ensured the delivery of newspapers to readers, which was especially important for rural areas with limited access to printed materials. The availability of newspapers increased their popularity, expanded readership, and promoted literacy and interest in the written word. Since subscriptions provided regular access to content, they played an educational and informational role in society.

[14] There are, of course, clear reasons why contemporary reflections on technological development (including the integration of global communication networks) and the focus on sustainability and resilience cannot be fully incorporated into this parallel.

[15] Advertisements were also published in popular folk calendars, which were widely read among the lower social classes. These calendars were one of the few sources of written content available to illiterate or less-educated individuals, contributing to the development of a reading audience. Among other examples, *Die Drau*, in its 100th issue from 1878, published advertisements for the *Catholic Folk Calendar for 1879* (*Katholischer Volkskalender für das Jahr 1879*) and the *Austrian Folk Calendar for 1879* (*Österreichischer Volkskalender pro 1879*), published by Moritz Perles from Vienna.

Photograph 3: A subscription call for *Slavonische Presse* published by *Slavonische Presse* itself in 1914 (Issue No. 215)

Source: https://www.difmoe.eu/view/uuid:c05798fe-14fa-4f60-81b2-f3ca4d8400f8?page=uuid:26d64057-e36e-4a8f-b065-69812b526148

Photograph 4: Advertisement for a new novel in *Die Gartenlaube* (*Slavonische Presse*, August 10, 1910, No. 181) and the cover of *Die Gartenlaube* featuring the first part of the advertised novel *Familie Lorenz* (No. 27, 1910)

Sources: https://www.difmoe.eu/view/uuid:14c884b7-3525-403d-a948-172f1cbd8cb8?page=uuid:1e87409f-8f4c-456f-8f0e-de76f8ad437f & https://books.google.hr/books?id=9FZ4wu9FTy0C&pg=PA512-IA2&source=gbs_selected_pages&cad=1#v=onepage&q&f=false

Advertisements often promoted literary works (Photograph 5), particularly serialized novels, which were popular then. A notable category among key Osijek-based German-language publications' advertisements was the promotion of cinema screenings (Photograph 6).

Interestingly, during World War I and the first post-war years, the advertising space in *Slavonische Presse* was almost entirely occupied by cinema programs.

Photograph 5: Advertisement for a Jules Verne book in *Die Drau* from 1877 (No. 54)

Izvor: https://www.difmoe.eu/view/uuid:2e75a18d-7f0b-46b8-aae4-3ed39e0a41ab?page=uuid:628084f7-1129-40a1-991e-e304f771a1eb

Photograph 6: Repertoire of film screenings published in *Slavonische Presse* from 1914 (No. 215) and 1916 (No. 32)

Sources: https://www.difmoe.eu/view/uuid:490bc5a4-ea38-4b0c-bf3f-88b8db185ce6?page=uuid:a73ca77c-d486-4f18-9eab-cd9ab0b479fb & https://www.difmoe.eu/view/uuid:454b952d-42c5-478a-9dce-9e2687e753da?page=uuid:cd437180-a83d-46ac-b2c9-3d9a9a74fbd1

Music was an essential part of life for all social classes of that era. Readers were attracted by advertisements in *Slavonische Presse* for piano lessons, as well as the rental or purchase of second-hand instruments. Equally prominent were advertisements for the latest sheet music editions and gramophone records (Photograph 7). *Die Drau* featured ads for ocarinas[16] and warnings about counterfeit versions of this musical instrument (Photograph 8). *Essegger Bote*[17] advertised the sale of violins and accordions. The city's musical life was enriched by various performances, such as the *Varieté- und Cabaret Ensemble* in 1906. An advertisement published in *Slavonische Presse* announced two performances, explicitly noting that they were part of a *respectable family program*.[18]

Photograph 7: Advertisement for the sale of gramophone records in *Slavonische Presse*, 1906 (No. 158)

Source: https://www.difmoe.eu/view/uuid:68f878ef-75fc-4291-8f6f-4b973fecf428?page=uuid:ec86831d-392e-4a89-a7a8-f71beae93c58

[16] Ocarina (Ital.), a children's or amateur wind instrument of an elongated, spindle-like shape. It is produced in various sizes (up to 15 cm) from terracotta, porcelain, or metal. In its modern form, it was created around 1867 by G. Donati di Budrio. (*Prolexis Encyclopedia Online*)

[17] Calendar, full title *Essegger Bote Illustrierter Kalender für Stadt- und Landleute* (Illustrated Calendar for City and Country People).

[18] *Slavonische Presse*, 1906 (No. 148), source: https://www.difmoe.eu/view/uuid:68f878ef-75fc-4291-8f6f-4b973fecf428?page=uuid:ace411cf-3c0f-4c5a-8642-f6ee31f9c60f

Photograph 8: Advertisement for the ocarina and a warning about counterfeit products in *Die Drau* from 1877 (No. 1 and No. 19)

Sources: https://www.difmoe.eu/view/uuid:4a85c975-6162-42fd-9033-a9093c1cb60e?page=uuid:8deb787b-68b9-4205-b0ef-dc6fdabc7f76 & https://www.difmoe.eu/view/uuid:7560c7f4-1af0-4128-950e-dd76da78b90a?page=uuid:a2a73114-ea2b-4883-bff6-5b7d9f906f68

Cultural events were not only advertised through large posters[19] in the city but also in *Die Drau*. Various performances, such as the *Grande Cirque Equestre* (Photograph 9), mystical exhibitions of the "Anthropological Museum" (Photograph 10), exhibitions of large sea creatures (shark, dolphin, etc.), performances of the mysterious bearded wonder lady (*Die bärtige Wunderdame*, 1873), or the artistic ensemble *Actien Theater* of the Matula brothers (1875), undoubtedly attracted a large audience from Osijek's citizenry.

Photograph 9: Announcement of the *Grande Cirque Equestre* performance in *Die Drau* from 1872 (No. 76)

Source: https://www.difmoe.eu/view/uuid:58961ce5-c522-4c45-9e56-71bd25ee9016?page=uuid:753a746e-0264-4b38-a1ab-3385d73cfbac

[19] Evident from the texts of the digitized advertisements themselves.

Photograph 10: Invitation to the anthropological exhibition published in *Die Drau* from 1872 (No. 71) and the fish exhibition from 1874 (No. 70)

In der Oberstadt täglich geöffnet von 8 Uhr Früh bis Abends.
I. Abtheilung:
anthropologisches Museum
enthält nur 200 der interessantesten Darstellungen über das Körperleben des Menschen mit vielen lebensgroßen geöffneten Figuren verfertigt von den ersten Künstlern Europas.
Das Museum ist Dienstag und Freitag Nachmittags von 2 Uhr ab speciell nur für Damen geöffnet.
Entreé a Person 30 kr.
II. Abtheilung:
Stereoscopen „Monstre" Galerie darstellend die Erdreise, bestehend in Glasphotographien und Seidentransparenten; j der Besucher der letzteren Abtheilung erhält ein Geschenk.
Entreé a Person 30 kr.
Achtungsvoll
Reinhard Grob.

Noch nie dagewesen!
Ein Riesen-Haifisch
welcher in der Wiener Weltausstellung zahlreich besucht und angestaunt wurde
Dieser fürchterliche Menschenfresser, dessen Fang die glaubwürdigsten Blätter mittheilten, wurde am 16. April 1872 in der Nähe Fiume's zufällig mittelst eines Fischernetzes gefangen, bei dieser Gelegenheit fand man in seinem ungeheuer großen ausgedehnten Magen, außer einer Menge von Fischen:
1. Ein Lamm,
2. Einen 350 Pfund schweren Delphin.
3. Die Leiche eines verunglückten Matrosen, welcher an seinem blauen Militärheund, Socken und Schuhen, als zur k. k. Marine gehörig agnoszirt wurde.
Der Schauplatz befindet sich: Essek, Oberstadt, am Heuplatz.
Eintrittspreise: 1. Platz 20 kr.
2. Platz 10 kr.
Um zahlreichen Besuch bittet
M. Horovitz.
223—1 aus Wien.

Sources: https://www.difmoe.eu/view/uuid:04f51412-2d32-488e-98e1-103e4e22b729?page=uuid:0f23b905-e54f-4108-bd43-ca1506ee961f & https://www.difmoe.eu/view/uuid:02f4e835-78be-4108-82d1-277c7ddfddcd?page=uuid:67d523e1-1e4c-4eb9-9127-55879197879c

Advertisements also reflected the social norms of the time, such as gender stereotypes and idealized family structures. Male figures were often depicted as authorities, while female figures were associated with household duties and family care.[20] Referring to Župan (2013), Červenjak and Živaković Kerže (2014, 131) emphasize that despite modernization processes, the traditional gender division persisted in the 19th century, with male dominance remaining unquestioned. Differences between men and women were considered natural evident in all aspects of life at the time. The most visible distinctions were in the education of boys and girls, the position of women and girls within the family, and their status in social and public life. The notion that "the woman of civil society was expected to be entirely devoted to family life" (Župan, 2013) is confirmed by advertisements from this period published in German-language newspapers. These advertisements reflect and reinforce the dominant patriarchal ideology in which a woman in civil society was reduced exclusively to the role of wife and mother, thereby limiting her social visibility and activities outside the family framework. According to Župan (2013), a woman's sphere of activity was the private domain, while the public sphere belonged to men. Through this division of public and private life, desirable feminine traits—modesty, fidelity, calmness, orderliness, and morality—were constructed (Luetić, 2014).

[20] Exhibition catalogue *All Those Household Chores!* (2009).

Photograph 11: Subscription invitation for women's magazines *Der Bazar* and *Illustrierte Frauenzeitung* published in *Die Drau* in 1874 (No. 74 and No. 89)

Der Bazar

Illustrirte Damen-Zeitung

vierteljährlich fl. 1. 50 Kr. ö. W.

mit Postversendung franco fl. 1. 90 bis fl. 2 —

Der Bazar lehrt durch Abbildung und Beschreibung die Selbstanfertigung aller Gegenstände aus dem Bereiche der Mode- und weiblichen Handarbeiten nach dem modernsten Geschmack. Jährlich erscheinen über 2000 Abbildungen und gegen 300 Schnittmuster in natürlicher Größe, Original-Muster für alle Arten Stickerei, Häkel, Strick- und Phantasie-Arbeiten. — Die belletristische Nummer bringt Novellen, Essais, Musik, Räthsel, Rebus, Schach, Recepte, Correspondenz mit Abonn., Modenberichte 2c. sowie Illustrationen berühmter Künstler.

Alle 14 Tage erscheint eine Doppel-Nummer im Umfange von 3—4 Bogen mit vielen Illustrationen und Schnittmustern.

Bestellungen werden jederzeit von allen Buchhandlungen und Postanstalten angenommen. Erstere liefern auf Wunsch Probe-Nummern zur Ansicht. 353—8

Illustrirte Frauen-Zeitung.

Ausgabe der „Modenwelt" mit Unterhaltungsblatt.

Gesammt-Auflage allein in Deutschland 180,000

Erscheint alle 14 Tage.

Pro Quartal 1 Guld. 50 kr. ö. W.; mit Franco-Postversendung 1 Guld. 90. kr. ö. W.

Jährlich: 24 Nummern mit Moden und Handarbeiten, gegen 2000 Abbildungen enthaltend: 12 Beilagen mit etwa 200 Schnittmustern für alle Gegenstände der Toilette und etwa 400 Musterzeichnungen für Weisstickerei, Soutache etc. 12. Grosse colorirte Modenkupfer. 24. Illustrirte Unterhaltungs-Nummern.

Grosse Ausgabe. Pro Quartal 2 Guld. 55 kr. ö. W.; mit Franco-Postversendung 3 Guld. ö. W.

Jährlich, ausser Obigem: noch 36 grosse colorirte Modenkupfer, darunter 12 Blätter mit etwa 150 historischen und Volks-Trachten.

Die Modenwelt,

ährlich: 24 Nummern mit Moden und Handelarbeiten sowie 12 Schnittmuster-Beilagen (wie bei der Frauen-Zeitung,) kostet pro Quartal nur 75 kr. ö. W.; mit Franco-Postversendung 1 Gulden 5 kr. ö. W.; Abonnements werden jederzeit angenommen. wo der Bezug durch eine Buchhandlung oder Postanstalt Unbequemlichkeiten haben sollte, erbietet sich die Verlags-Expedition in Berlin; W., Potsdamerstr. 38, zur directen Uebersendung. Eine Probe-Nummer nebst Übersicht der Preisbedingungen für die verschiedenen Länder liefert die Expedition auf frankirtes Verlangen gratis und franco.

Sources: https://www.difmoe.eu/view/uuid:002548af-e619-4b14-a7ce-59cac32f384d?page=uuid:07e27399-ca4d-489b-b856-4517f63faa6d & https://www.difmoe.eu/view/uuid:f33d30fd-af3f-46d6-9563-37d7a8d87c11?page=uuid:bb886217-a322-4dfa-965e-7cdbe3de4fae

In this context, for example, in 1874, various issues of *Die Drau* advertised German-language women's[21] magazines such as the biweekly *Der Bazar – Illustrierte Damen-Zeitung* and its equivalent *Illustrierte Frauenzeitung: Ausgabe der Modenwelt mit Unterhaltungsblatt* (Photograph 11). Very similar in content, they featured topics on fashion, women's handicrafts, literature (novels, short stories, essays, poetry), music, entertainment, chess (sic!), and culinary recipes.[22] According to Župan (2013), women's education was only meant to pass down values to children and be tied to family and household duties rather than professional development. Consequently, a woman's fulfillment could only be achieved through marriage. To help an exemplary and diligent housewife reach this ideal, sewing machines (*Pfaff, Howe, Singer*)[23] were intensely advertised. A merchant named Müller from Vienna emphasized—with an

[21] The original content specifically used the adjective "female" to describe handicrafts (*weibliche Handarbeiten*). According to Župan (2013), this activity positioned women within the private sphere of the home, which was considered their natural place according to the value system of that time.

[22] Thanks to digitization, copies of both magazines are available at https://www.digitale-sammlungen.de/de/details/bsb11176095 and https://digital.ub.uniduesseldorf.de/ihd/periodical/titleinfo/3085194

[23] Between 1862 and 1868, the name *Pfaff* was not yet used for the sewing machine factory, as the machines were initially produced according to the Howe system and later the Singer system. It was only in 1872 that Pfaff operated under the name *Singer* Sewing Machine Factory.

exclamation mark—that his advertisement was essential to ladies, offering various clothing patterns of all sizes while stressing that no prior knowledge was required (Photograph 12). At the same time, every good housewife needed a tastefully and elegantly decorated home, and young mothers (or their governesses) were expected to stroll with their children in fashionable baby carriages proudly. It could be found at the well-known store of Mr. Rayal[24], located in the heart of Osijek on *Kapucinska* Street (Photograph 13). Specialized cookware for making jams (Photograph 14) was advertised as a way to ensure high-quality homemade products, which were an essential part of desserts served on fine porcelain[25] during women's afternoon gatherings over a cup of Chinese tea or, later, freshly roasted coffee from the *First Osijek Coffee Roastery* (Photograph 15).

Photograph 12: Advertisement for clothing patterns in *Die Drau*, 1877 (No. 13)

Wichtig für jede Dame!
Neueste Erfindung!
Kais. königl. ausschl. priv.
Chablone universelle.
Womit sich jede Dame selbst, sowie auch einer Anderen das passendste Kleid machen kann.
Vorkenntnisse nicht nothwendig. Mit dieser Chablone kann man jede Façon und jede Grösse für Kinder von 1 Jahr aufwärts bis zur grössten Person den Schnitt in 5 Minuten herstellen und auch das Kleid, respective Leib, ohne Vorkenntnisse fertig machen.
Preis per Stück sammt Gebrauchsanweisung 2 fl., per Nachnahme 2.10, 2 Stück 4 fl. und 6 Stück 11.50. — Einzig und allein zu haben bei
H. M. Müller, Wien, VII. Kaiserstrasse Nr. 26.
NB. Nur die von mir bezogenen, mit meiner Stampiglie und Schutzmarke versehenen sind gut und erfüllen obigen Zweck
Herrn J. M. MÜLLER, hier. Ich kann Ihnen nicht genug danken für diese wirklich gute Erfindung, denn kaum 5 Minuten brauchte ich, um einen vollständigen Schnitt herzustellen und jetzt ist es mir auch möglich, das passendste Kleid zu machen, obwohl ich als Kleidermacherin bin. Josefstadt, den 29. December 1876.
ANNA BALLI m. p.

Source: https://www.difmoe.eu/view/uuid:d6ee1097-258d-46cc-9e7a-e5e74aba3b47?page=uuid:55d73ada-da41-440f-8e92-319568e5947f

Photograph 13: Advertisement of Osijek merchant Franz Rayal in *Die Drau* from 1877 (issue no. 47)

Pferdedecken und Kotzen zu bedeutend herabgesetzten Preisen,— sämmtliche Bettwaaren, Rosshaar-Matratzen, abgenähte Bettdecken, beste Sorte Flanelldecken diverser Qualität, Tisch-, Bett- und Couvertdecken, Laufteppiche, Matratzen Gradl, Ronge, alle Farben feinste Sattins und Cachemir, Chiffons. Die beste Art von Betteinsätzen mit galvanisirten Sprungfedern, mit und ohne Polsterung werden unter Garantie auf's beste nach Maass und sonstiger Angabe effectuirt.
Auch hält Endesgefertigter ein grosses Lager von Eisenbetten, Kinderbetten, Kinderwiegen, Kinderwägen etc. — Rohrsessel aus massiv gebogenem Holze (Thonet), und andere Lager-Artikel sind stets in grosser Auswahl vorräthig in
der Bettwaaren-Niederlage des
Franz Rajal, Essek, Oberstadt, Kapuzinergasse.

Source: https://www.difmoe.eu/view/uuid:5274a355-30ac-4bbe-a594-6b392c47635c?page=uuid:21d1a845-c438-40e2-a6ec-bd9f1db7e99b

[24] A store with a wide range of products: mattresses, bedding, blankets, high-quality fabrics (cashmere, satin, chiffon); floor runners; cradles, baby cribs, strollers; *Thonet* solid wood chairs, as well as horse blankets.

[25] In its pre-Christmas edition (Issue 102) from 1884, *Slavonische Presse* published an advertisement by merchant *St. Heim* for porcelain dishes, dining sets, and coffee or tea sets.

Photograph 14: Advertisement from *Die Drau* for jam-making utensils from 1875 (No. 48)

Source: https://www.difmoe.eu/view/uuid:36140144-4660-4534-880a-c82c43941b87?page=uuid:3a294526-77f9-43bc-aaf0-6015a03f24b8

Photograph 15: Advertisements for Chinese tea from 1885 (No. 1) and the First Osijek Coffee Roastery from 1906, published in *Slavonische Presse* 1906 (No. 148)

Sources:
https://www.difmoe.eu/view/uuid:57dacb26-93fe-4797-bc73-f7d8d5aed0f4?page=uuid:0b3453f1-778c-4684-b198-526ca6c5e563 &
https://www.difmoe.eu/view/uuid:68f878ef-75fc-4291-8f6f-4b973fecf428?page=uuid:b10a9620-ac01-4532-a666-0087f8dab392

Finally, but no less critical, is that a series of richly illustrated advertisements were published, dedicated to the ideal of female beauty, promoting products such as cosmetics, perfumes, soaps, and fashion accessories, often emphasizing aesthetics and sophistication as key values. For

example, porcelain powder was advertised in *Die Drau*[26] and *Slavonische Presse*[27]. It historically refers to a cosmetic product that was popular in various periods, especially among women striving for the ideal of porcelain skin. Historically, pale skin symbolized social status, indicating a life away from physical labour outdoors. Porcelain powder was essential in shaping an aesthetic ideal emphasizing sophistication and femininity.
In conclusion, contemporary sustainable entrepreneurial ecosystems also take into account local cultural and social contexts to be successful and sustainable.

4.2. Innovation and adaptation

In the context of seeking standard features between old advertisements from the 19th/20th centuries and the contemporary sustainability canon, certain types of ads can be identified that were tailored to the local market and used cultural symbols recognizable to the local scene. Advertisements often promoted products specific to a given region, such as local food products, alcoholic beverages, and so on. For example, wine sales were frequently advertised (Photograph 16), while J. Bartolovich advertises table wines in *Slavonische Presse* (1906, issue no. 148), and a certain Josef Hüber sells various types of wines from Villany[28] at a discounted price (*Die Drau* from 1914, issue no. 2).

Photograph 16: Advertisements for wines from *Slavonische Presse* and *Die Drau*

Wein-Kleinverkauf in Flaschen!
Tischweine: Schiller- und Weißweine — — 56 Hel.
Extra-Rotweine und alte Weißweine 64 „
1898-er Riesling — — — 72 „
Weinessig — — — — 56 „
Bestellungen, mindestens 12 Liter, werden ins Haus gestellt.
Ich bitte sich durch einen Probeauftrag von der vorzüglichen Qualität zu überzeugen
Essegg-Unterstadt, Platzgasse. — Telephon 94.
Josef Bartholovich.

Telephon Nr. 308 Telephon Nr. 308.
Weinpreise-Reduzierung!
Erlaube mir Ihnen zur gefälligen Kenntnis zu bringen, daß ich meinen vorzüglichen
Villányer Wein
zu reduzierten, laut unten verzeichneten Weinpreisen, bis auf Widerruf in Flaschen von 1 und 1½ Liter vorrätig gefüllt habe u. zw.
Schiller-Wein neu per 1 Liter K —.72
Weiß-Wein neu per 1 Liter K —.72
Weiß-Wein alt per 1 Liter K —.80
Schiller-Wein alt per 1 Liter K —.80
Rieslinger 5-jährig per 1 Liter K 1.20
Rotwein alt 5-jährig per 1 Liter K 1.60
bei Abnahme von 6 Flaschen franco ins Haus geliefert.
Von meinen Villányer Rotwein Keller in Fässern von 100 Liter aufwärts ab Bahnhof Villány berechne billiger.
Indem ich meine vorzüglichen Weine bestens empfehle und die billigsten Preise und zuvorkommendste Bedienung zusichere, zeichne
Hochachtungsvoll
JOSEF HÜBERT
Spezerei-, Mehl-, Material-, Farbwaren- und Weinhandlung.
Osek-Oberstadt, Strakonicergasse Nr. 67.

Sources: https://www.difmoe.eu/view/uuid:db47c294-b38f-4e54-97d8-39a169996f0b?page=uuid:e1bfef72-c429-4cee-b7e7-a36a37a08ec7 & https://www.difmoe.eu/view/uuid:68f878ef-75fc-4291-8f6f-4b973fecf428?page=uuid:08bad8a8-2884-4b89-b47c-1cfef370bb29

[26] Advertisement for *Klythia* Powder published in 1898 Issue No.77 https://www.difmoe.eu/view/uuid:b302cd7c-bf16-4736-a2cc-a45927b1b959?page=uuid:38317a28-c05c-4dc7-a106-5dc2a284dbb3&fulltext=Klythia%20Puder

[27] Advertisement for *Jesz* Porcelain Powder published in 1912 Issue No.175 https://www.difmoe.eu/view/uuid:6296dde7-8710-40fb-8cea-92e985c1e9e3?page=uuid:ba365c70-346a-4d3e-9d7e-c8dfbac6a192&fulltext=Porzellan

[28] A place known for wine production, located at the Croatian-Hungarian border (the aerial distance 40 km).

The characteristics of modern entrepreneurial ecosystems in terms of innovation and adaptability to global challenges and changes can also be seen in the advertisements published in the old Osijek newspapers. Specifically, during World War I and immediately after, there is a clear shift in the function and tone of advertising. Instead of the classic promotional ads that try to convince the consumer of the advantages of a particular product, ads in the form of demand dominate – buyers and traders advertise what they are looking for or need to acquire. This change is not incidental but is directly related to the wartime and post-war circumstances, marked by shortages of necessities, trade restrictions, and the interruption of previously established supply chains. During the First World War, food became a scarce – and thus decisive – resource for the Habsburg Empire's warfare, concerning the armed forces as well as the people on the "home front." (Langthaler, 2016)

Photograph 17: Advertisement for the purchase of wild chestnuts and cherry pits – an ad from 1916 published in *Slavonische Presse* (No. 32)

Seite 6 Osijek, Mittwoch

Wildkastanien

und

Zwetschkenkerne

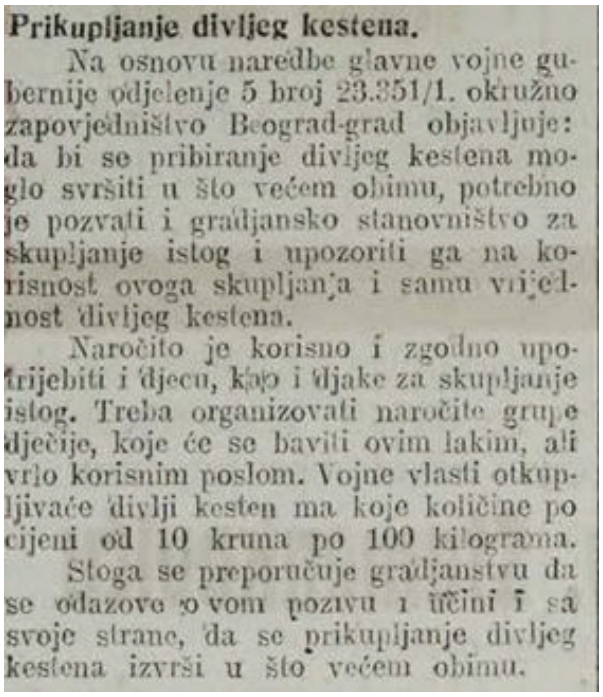
kauft jedes Quantum der Ersteher der Wildkastanien der Stadt Osijek Leopold Leitner Osijek Schanzelgasse 7 (Telefon Nr. 568)

Source: https://www.difmoe.eu/view/uuid:454b952d-42c5-478a-9dce-9e2687e753da?page=uuid:cd437180-a83d-46ac-b2c9-3d9a9a74fbd1

Advertisements from this period are significantly more modest, which, from a marketing perspective, suggests an adaptation to global challenges and changes. One straightforward, seemingly unremarkable newspaper advertisement (Photograph 17) from 1916 hides a crucial historical story that had a decisive impact on the course of the Great War. At this time, commission sales became an important form of economic survival under scarcity and disrupted market flows. People who acted as commission sellers, such as the merchant Leopold Leitner from Osijek, took on an intermediary role between the state or more significant purchasers and the local population, which collected or offered goods and raw materials for sale. It was also the case with the organized commission sales and purchase of wild chestnuts, which at the time

began to be used intensively in the war industry.[29] Both *Die Drau* and *Slavonische Presse* published advertisements in the fall months of 1915 and 1916, calling on citizens to sell wild chestnuts. Thanks to these ads and calls for collection (Photograph 18), the importance of organized collection of natural raw materials in the wartime economy is evident,[30] with commission sellers playing a key logistical role.

Photograph 18: Excerpt from *Belgrade Newspapers* of October 13, 1917 (No. 281) – Call for wild chestnut collection



Prikupljanje divljeg kestena.

Na osnovu naredbe glavne vojne gubernije odjelenje 5 broj 23.351/1. okružno zapovjedništvo Beograd-grad objavljuje: da bi se pribiranje divljeg kestena moglo svršiti u što većem obimu, potrebno je pozvati i gradjansko stanovništvo za skupljanje istog i upozoriti ga na korisnost ovoga skupljanja i samu vrijednost divljeg kestena.

Naročito je korisno i zgodno upotrijebiti i djecu, kao i djake za skupljanje istog. Treba organizovati naročite grupe dječije, koje će se baviti ovim lakim, ali vrlo korisnim poslom. Vojne vlasti otkupljivaće divlji kesten ma koje količine po cijeni od 10 kruna po 100 kilograma.

Stoga se preporučuje gradjanstvu da se odazove ovom pozivu i učini i sa svoje strane, da se prikupljanje divljeg kestena izvrši u što većem obimu.

Source: https://pretraziva.rs/show/beogradske-novine--1917-10-13.pdf

In aesthetic terms, the elaborate visual ornamentation characteristic of styles like Art Nouveau or Art Deco, which dominated advertisements at the end of the 19th and early 20th centuries, disappeared.[31] During the war and post-war years, form lost its importance in favour of function—the textual content became direct and informative. At the same time, illustrations appeared only occasionally and were often very simple. This visual and content scarcity further attests to the severity of the times and the changed priorities—advertising was no longer a means of prestige but rather a practical tool for survival and essential supply.

4.3. Economic and social impact

Advertisements contributed to the local economy and social development, similar to the role that contemporary sustainable entrepreneurial ecosystems play in promoting economic and social progress. Even though the main parts of Osijek (Donji grad, Tvrđa, Novi grad, and Gornji

[29] Wild chestnut contains starch, which could serve as a raw material for the production of acetone, a crucial component in the production of explosives such as cordite. This process, known as the Weizmann process, allowed for the fermentation of yeast from starch to produce compounds essential for military purposes. https://www.weizmann-usa.org/blog/chaim-weizmann-s-acetone-discovery-was-key-to-british-wwi-effort/

[30] The *Agramer Zeitung* from November 12, 1916, describes penalties for municipalities that failed to meet the quotas for collecting chestnuts.

[31] Compare with M. Feller, *Psychodynamics of Advertising*.

grad) were united into the Free and Royal City of Osijek in 1809, all of them—except for Tvrđa—retained the characteristics of a somewhat more developed rural area. Tvrđa had its own water supply and sewage system.[32] Frequent epidemics in the city were the result of water supply issues, which, according to Živaković Kerže (2008, 150), required that specific health and hygiene standards be imposed in Osijek. The city authorities had to address one of the key issues for Osijek—how to ensure the supply of clean and potable water, especially for the Gornji grad area, which, from the second half of the 19th century, took on a leading political, economic, and cultural role from Tvrđa. Introducing a water supply system represented an essential step in the further intensive development of that part of the city.

The early 20th century and the emergence of Art Nouveau brought significant changes to the housing culture. Impressive single-story Art Nouveau houses, and occasionally two-story buildings, constructed in 1905 and 1906 in the eastern, still peripheral part of the Gornji grad, contributed to the impression of Osijek as a modern European city. This impression was not based solely on the aesthetic value of the architecture but also on the high hygienic standards: the newly built houses on *Chavrakova* Street (now European Avenue) were equipped with running water and so-called English-style toilets. Significant funds for modern bathroom and sewage infrastructure were invested by 24 of the wealthiest citizens of Osijek at the time (Červenjak and Živaković-Kerže, 2014, 132). Shortly thereafter, advertisements from V. Axmann and J. Domes authorized civil architects and builders, began to appear in local newspapers offering their services. Among other things (Photograph 19), they listed the installation of water supply systems, gas lighting, and bathrooms and toilets.

Photograph 19: Advertisement for architectural and construction services by Axmann and Domes, published in *Slavonische Presse* in 1909 (No. 185)

Source: https://www.difmoe.eu/view/uuid:69427b25-cd8d-40cd-8193-ca78e8eb391c?page=uuid:46278436-1157-4a6c-bd27-493d89ff713e

[32] According to Živaković Kerže (2008), the first public water supply in Tvrđa was opened by the military authorities in 1751, with two water pumps set up along the Drava riverbank. By 1779, it also had a "real public sewage system."

Street gas lighting began in Osijek in 1884, and the city's gasification was completed in February 1885, when the work on laying gas pipes was finished. In the following years, gas was increasingly introduced into private households, primarily due to the interest of wealthier citizens who used it in their everyday lives (Photograph 20).

Photograph 20: Advertisement for the sale of gas lamps for households from *Slavonische Presse* in 1909 (No. 185)

Source: https://www.difmoe.eu/view/uuid:69427b25-cd8d-40cd-8193-ca78e8eb391c?page=uuid:7c5ce4e9-f876-4d5d-b269-9014e3bd8bf0

At the end of the 19th century, Osijek developed into a multicultural economic centre, with several factories established, such as the brewery and match factory in 1856, leather factory in 1872, gas plant in 1884, furniture factory in 1892, flax factory in 1901, sugar factory in 1905, candy and the chocolate factory in 1907, soap factory in 1921, and biscuit factory in 1922.[33] Its favourable transportation position and access to local resources ensured stable growth, making it one of the most developed cities in Croatia. Due to the many advertisements published in the abovementioned periodicals, it is impossible to present them in detail in this work. However, by citing selected examples (Photographs 21-23), advertisements were essential for promoting local industry and strengthening social cohesion. They also served as a means of connecting Osijek to European markets, further contributing to its economic development.

[33] Croatian Encyclopedia, online edition

Photograph 21: Advertisement from *Slavonische Presse* about the opening of Povischil's furniture factory in 1891 (No.47)

P. T.

Ich beehre mich hiemit die höfliche Mittheilung zu machen, daß ich auf hiesigem Platze unter der handelsgerichtlich protokollirten Firma

Josef Povischil

eine allen Anforderungen der heutigen Zeit entsprechend reichsortirte

Möbel- und Tapezierer-Waaren-Handlung

errichtet habe.

Durch den Umstand, **daß ich Fachmann bin** und mir ferner als **langjähriger Geschäftsleiter der hiesigen renommirten Firma Rudolf Kaiser** mehr als ausreichende Geschäftskenntnisse erworben habe, so wie durch hinlängliche Fonds und **directe Verbindungen mit den ersten Fabriken,** bin ich in die angenehme Lage versetzt, stets nur ganz **vorzügliche Waare und Musterformen in elegantester Ausführung in reichster Auswahl zu den billigsten Preisen** dem geehrten Publikum bieten zu können; ferner übernehme ich alle in dieses Fach einschlägigen Arbeiten laut Maß und Planskizzen zur Anfertigung.

Indem ich versichere, daß ich mich des Vertrauens meiner Kunden stets würdig erweisen und bestrebt sein werde, mir dasselbe auch zu erhalten, bitte ich um die gütige Zuweisung Ihres Bedarfes in diesen Artikeln und zeichne

hochachtungsvoll

Josef Povischil.

Hauptlager: Stadthausgebäude. Werkstätte u. Filiale: Lange Gasse Nr. 11.

r: Carl Laubner. Druck von Carl Laubner, Essegg-Oberstadt, Kapuzinergasse Nr. 6.

Source: https://www.difmoe.eu/view/uuid:91a80d7e-fdfb-4a88-9ea8-9f8fa7538450?page=uuid:e6f437a1-8813-4892-923a-5270c74e9f86

Photograph 22: Advertisements for soaps from the *Schicht* factory published in *Die Drau* in 1903 (No. 42) and 1926 (No. 80)

Schicht-Seife

Marke:

„HIRSCH" „SCHLÜSSEL"

Beste, ausgiebigste und deshalbbilligste Seife. Frei von allen schädlichen Beimengungen.

Ueberall zu haben.

Beim Einkaufe achte man besonders darauf, dass jedes Stück Seife den Namen „Schicht" und eine der obigen Schutzmarken trägt.

Sources: https://www.difmoe.eu/view/uuid:ec21ef34-80c7-49c8-abf4-68d091f5055c?page=uuid:d5b0f1fd-6a87-4049-87e2-b13ba13a65a4&fulltext=Imperial-Continental%20Gas%20Association & https://www.difmoe.eu/view/uuid:a7ad15e3-d43e-46b6-8447-29e53582baf9?page=uuid:9cea2742-4632-4743-b56f-ad831a43832e

Photograph 23: The Osijek Foundry and Machine Factory advertisement published in *Die Drau* in 1914 (No. 66)

Source: https://www.difmoe.eu/view/uuid:ba6ebb46-f1c5-4d1b-973e-2c1e174fa1b1?page=uuid:4388e204-c80f-46cc-8a7e-fdf91b768c12

5. Conclusion

Contemporary sustainable entrepreneurial ecosystems, driven by principles of inclusivity, cultural sustainability, social cohesion, and collaboration, share common values with business practices from the past, which are reflected in the advertisements from Osijek newspapers of that period. Advertising strategies in old newspapers reflected local culture, fostered social connections, and emphasized the importance of cooperation among different community actors. Historical examples show how local entrepreneurs used advertisements to promote products and services, often relying on the community's cultural values, which contributed to strengthening social cohesion and sustainability. On the other hand, modern ecosystems integrate these same principles through innovative practices involving diverse stakeholders, from local communities to global markets.

In conclusion, historical and contemporary entrepreneurial practices analysis highlight the continued importance of cultural inclusivity and social connectivity as foundations for sustainable business development. Historical examples from Osijek provide valuable insights into how cultural heritage can shape contemporary business models, while modern approaches offer opportunities to enhance these values in a globalized world.

REFERENCES

Agramer Zeitung. Hrvatska enciklopedija, mrežno izdanje, Leksikografski zavod Miroslav Krleža, 2013.–2025. Available at: https://www.enciklopedija.hr/clanak/agramer-zeitung (Accessed 25 March 2025)

All those household chores! Museum of Slavonia, Osijek, guest appearance in Zagreb City Museum, Muzej grada Zagreba. Available at: https://www.mgz.hr/en/exhibitions/all-those-household-chores! (Accessed 18 March 2025)

ANNO Historische Zeitungen und Zeitschriften. Österreichische Nationalbibliothek. Available at: https://anno.onb.ac.at/node/15 (Accessed 18 March 2025)

Berkec, S. and Šarić Šokčević, I. (2020): ***Zu den zweisprachigen Werbeanzeigen in der Osijeker deutschsprachigen Zeitung Slavonische Presse im späten 19. und frühen 20. Jahrhundert***, *Pismo - Časopis za jezik i književnost*, Bosansko filološko društvo, Issue No: 18, pp. 23-44

Cavallo, A., Ghezzi, A., Sanasi, S. & Rangone, A. (2019): ***The Strategic-Value Network Model for Entrepreneurial Ecosystem Assessment***, *European Conference on Innovation and Entrepreneurship*, pp. 214-219.

Chaim Weizmann's Acetone Discovery was Key to British WWI Effort. Weizmann USA. Available at: https://www.weizmann-usa.org/blog/chaim-weizmann-s-acetone-discovery-was-key-to-british-wwi-effort/ (Accessed 23 March 2025)

Chaudhary, S., Kaur, P., Alofaysan, H., Halberstadt, J. and Dhir, A. (2023): ***Connecting the dots? Entrepreneurial ecosystems and sustainable entrepreneurship as pathways to sustainability***, *Business Strategy and the Environment*, 32(8). https://doi.org/10.1002/bse.3466 (Accessed 15 March 2025)

Cohen, B. (2006): ***Sustainable valley entrepreneurial ecosystems***, *Business Strategy and the Environment*, 15(1), pp. 1–14. https://doi.org/10.1002/bse.428 (Accessed 18 March 2025)

Červenjak, J. and Živaković-Kerže, Z. (2014): ***Modernizacijska kretanja i položaj žena u gradu Osijeku na prijelazu 19. u 20. stoljeće***, *Scrinia Slavonica*, 14(1), pp. 129-141. Available at: https://hrcak.srce.hr/130454 (Accessed 22 March 2025)

Der Bazar – Illustrierte Damen-Zeitung. Münchener DigitalisierungsZentrum, Digitale Bibliothek. Available at: https://www.digitale-sammlungen.de/de/details/bsb11176095 (Accessed 22 March 2025)

Deutschsprachige Zeitungen in Kroatien. DiFMOE. Available at: https://www.difmoe.info/projekte/deutschsprachige-zeitungen-in-kroatien/ (Accessed 25 March 2025)

Die Gartenlaube. Google Books. Available at: https://books.google.hr/books?id=9FZ4wu9FTy0C&redir_esc=y (Accessed 25 March 2025)

Die Geschichte der Nähmaschine. Senci. Available at: https://naehmaschinen-senci24.de/Die-Geschichte-der-Naehmaschine (Accessed 23 March 2025)

Dukić, D. (2015): ***Die Karlstädter Zeitschrift »Der Pilger« (1841–1847). ›Provinz-Journal‹ aus imagologischer Sicht – ein Forschungsentwurf***, *Zagreber germanistische Beiträge*, 24(1), pp. 149-168. https://doi.org/10.17234/ZGB.24.8 (Accessed 20 March 2025)

Erl Šafar, M., Lubina, T., and Subjak, R. (2022): ***German Newspaper Publishing in Osijek: From 1848 until 1945***, *Medijska istraživanja*, 28(1), pp. 79-99. https://doi.org/10.22572/mi.28.1.4 (Accessed 22 March 2025)

Esseker Allgemeine illustrierte Zeitung. Stare hrvatske novine portal digitaliziranih novina. Available at: http://dnc.nsk.hr/newspapers/LibraryTitle.aspx?id=621e5fc3-8ece-4bba-9e7e-67f6373e36cf (Accessed 20 March 2025)

Fatović-Ferenčić, S. & Ferber Bogdan, J. (2018): ***Otac i sinovi: članovi obitelji Feller u kontekstu početaka reklamnoga oglašavanja u Hrvatskoj***, *Acta medico-historica Adriatica*, 16(1), pp. 49-74. https://doi.org/10.31952/amha.16.1.2 (Accessed 19 March 2025)

Feller, M. (2022): ***Psihodinamika reklame***, Naklada Breza, Zagreb.

Fruk, M. (1997): ***Njemačko novinstvo u Osijeku***, *Godišnjak njemačke narodnosne zajednice – VDG Jahrbuch*, 4, Osijek, pp. 29–34.

Fruk, M. (2005): ***Das deutschsprachige Zeitungswesen in Kroatien in Riecke, J. and Schuster, B.M.***, ed: *Deutschsprachige Zeitungen in Mittel- und Osteuropa*, Weidler Buchverlag Berlin, Berlin, pp. 393-404-x.

Glušac, M. (2013): ***Osječke novine nekada i sada***, *Anali Zavoda za znanstveni i umjetnički rad u Osijeku*, 29, pp. 149-163. Available at: https://hrcak.srce.hr/150022 (Accessed 18 March 2025)

Illustrierte Frauenzeitung: Ausgabe der Modenwelt mit Unterhaltungsblatt. Heinrich Heine Universität Düsseldorf, Digitale Sammlungen. Available at: https://digital.ub.uni-duesseldorf.de/ihd/periodical/titleinfo/3085194 (Accessed 25 March 2025)

Kraus, L., Bojanić Obad Šćitaroci, B., Karač, Z., & Kraus, I. (2022): ***Disappearance and Sustainability of Historical Industrial Areas in Osijek (Croatia): Three Case Studies***, *Buildings*, 12(2), 196. https://doi.org/10.3390/buildings12020196 (Accessed 18 March 2025)

Knežević Križić, I. and Vinaj, M. (2022): ***Od male sličice do velike priče: Osječka tiskana građa tvornice Saponia u Odjelu knjižnice Muzeja Slavonije***, *Knjižničarstvo*, 26(1-2), pp. 11-23. Available at: https://hrcak.srce.hr/284499 (Accessed 25 March 2025)

Langthaler, E. (2016): ***Food and Nutrition (Austria-Hungary)***, *1914-1918 Online International Encyclopedia of the First World War*. Available at: https://encyclopedia.1914-1918-online.net/article/food-and-nutrition-austria-hungary/ (Accessed 22 March 2025)

Luetić, T. (2014): ***Dinko Župan, Mentalni korzet. Spolna politika obrazovanja žena u Banskoj Hrvatskoj (1868-1918)**, Bibliotheca Croatica: Slavonica, Sirmiensia et Baranyensia*, studije, knj. 17, Učiteljski fakultet u Osijeku – Hrvatski institut za povijest, Podružnica za povijest Slavonije, Srijema i Baranje, Osijek – Slavonski Brod, 2013., *Zbornik Odsjeka za povijesne znanosti Zavoda za povijesne i društvene znanosti Hrvatske akademije znanosti i umjetnosti*, 32, pp. 313-317. Available at: https://hrcak.srce.hr/136458 (Accessed 20 March 2025)

Matić, Ž. (2023): ***Berlin: Predavanje „Povijest Osijeka kroz povijest osječkih novina“**, Berlinski magazin*. https://berlinskimagazin.com/vijesti/video-foto-berlin-predavanje-povijest-osijeka-kroz-povijest-osjeckih-novina/ (Accessed 25 March 2025)

Obad, V. (2007): ***Regionalpresse Österreich-Ungarns und die urbane Kultur***, Feldmann Verlag, Wien.

Okarina. Prolexis enciklopedija online. Available at: https://proleksis.lzmk.hr/39581/ (Accessed 25 March 2025)

Osijek. Hrvatska enciklopedija, mrežno izdanje. Leksikografski zavod Miroslav Krleža, 2013.–2025. Available at: https://www.enciklopedija.hr/clanak/osijek (Accessed 24 March 2025)

Osječke novine na njemačkome jeziku. Muzej Slavonije. Available at: https://novine.mso.hr/ (Accessed 25 March 2025)

Pederson, S. (2022): ***Digitized German-language Newspapers**, Nineteenth-Century Music Review*, 19(1), pp. 199- 204 https://doi.org/10.1017/S1479409821000422 (Accessed 25 March 2025)

Penava Brekalo, Z. (2022): ***Industrijalizacija grada Osijeka: poseban osvrt na prve dvije faze industrijskoga razvoja***, *Mostariensia*, 26(1), pp. 105-116. https://doi.org/10.47960/2831-0322.2022.1.26.105 (Accessed 21 March 2025)

Povijest osječke Plinare, plinske rasvjete i proizvodnje plina iz ugljena. croatia.ch, Hrvatski portal u Švicarskoj. Available at: https://www.arhiva.croatia.ch/zanimljivosti/151210.php (Accessed 25 March 2025)

Stare hrvatske novine. Portal digitalnih novina. Nacionalna i sveučilišna knjižnica. Available at: http://dnc.nsk.hr/Newspapers/Search.aspx (Accessed 25 March 2025)

Stolac, D. (2017): ***Jezične strategije reklama u 19., 20. i 21. stoljeću – sličnosti i razlike***, Univerzita Mateja Bela v Banskej Bystrici, Vydavateľstvo Belianum, pp. 125-133. Available at: https://www.bib.irb.hr:8443/972601 (Accessed 19 March 2025)

Šarić Šokčević, I. and Jozić, I. (2022): ***Werbeanzeigen aus den Osijeker deutschsprachigen Zeitungen Die Drau und Slavonische Presse als Sprach- und Kultur(ver)mittler im späten 19. und frühen 20. Jahrhundert*** in Mešić, S. and Hrustić, M., ed.: *Sprach- und Kultur(ver)mittlung*, Društvo germanista u Bosni i Hercegovini (DGuBiH), pp. 98-113.

Vinaj, M. (2003): ***Građa za bibliografiju osječkih novina: 1848.-1945.*** *Knjižničarstvo: glasnik Društva bibliotekara Slavonije i Baranje*, 7, 1/2, pp. 7-35.

Vinaj, M. (2007): ***Osječki časopisi do 1945. godine u Muzeju Slavonije Građa za bibliografiju***, *Osječki zbornik*, 28(xx), pp. 327-334. Available at: https://hrcak.srce.hr/161702 (Accessed 19 March 2025)

Živaković-Kerže, Z. (2008): ***Prvi javni vodovod u Osijeku***, *Scrinia Slavonica*, 8(1), pp. 147-151. Available at: https://hrcak.srce.hr/42036 (Accessed 25 March 2025)

Župan, D. (2013): ***Mentalni korzet – Spolna politika obrazovanja žena u Banskoj Hrvatskoj (1868-1918)***, Hrvatski institut za povijest Podružnica za povijest Slavonije, Srijema i Baranje, Osijek – Slavonski Brod i Učiteljski fakultet u Osijeku.

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THE RELATIONSHIP BETWEEN ARTIFICIAL INTELLIGENCE AND PERFORMANCE IN DIGITAL STARTUPS

ABSTRACT

The paper examines the relationship of artificial intelligence (AI) and the performance of startup companies. The importance of artificial intelligence is examined in relation to the factors of information technology usage and startup company performance. In particular, the connection between artificial intelligence and business intelligence in startup companies is analyzed. The empirical study was conducted on a sample of 50 startup companies in Croatia. The correlations between artificial intelligence, information technologies and the performance of startup companies were examined. By methodically structuring the factors of digital entrepreneurship and analyzing the relationship between artificial intelligence and the performance of startup companies, new insights can be gained about the possibilities and guidelines for the development and use of artificial intelligence in terms of sustainable development and the success of startup companies.

Key words: *artificial intelligence, business performance, digital entrepreneurship, startups.*

1. Introduction

In the age of ubiquitous digitalization, startups are facing challenges and opportunities that go far beyond the traditional applications of information technologies. The increasing integration of artificial intelligence (AI) into business processes has not only changed the use of information technology (IT), but also the way startups collect, analyze and use data to innovate, make decisions and gain competitive advantage. AI is no longer just a supporting technological tool, but has become a strategic enabler for organizational agility, operational efficiency and sustainable growth, especially in dynamic and competitive startup ecosystems. Recent research shows that startups that systematically integrate AI technologies into their information infrastructures demonstrate higher levels of innovation, adaptability to market changes and improved business performance outcomes (Adekunle et al., 2024, Schulte-Althoff et al. 2021). AI enables improved personalization, predictive analytics, real-time optimization and automation of core business processes, significantly changing the traditional role of information technology in entrepreneurial contexts (Usman et al., 2024, Davenport et

al. 2020). In addition, the synergistic interaction between artificial intelligence and business intelligence (BI) systems enables proactive prediction of market trends, advanced decision-making and more effective customer engagement strategies, directly contributing to the scalability and long-term profitability of startups (Ebule, 2025, Al-Momani, 2024, Judijanto et al., 2023).

Given the strategic importance of these technological changes, the study aims to examine the relationship between the application of AI and the business performance of startups, with a particular focus on how AI-enhanced BI systems influence entrepreneurial performance. The main objective of the study is to analyze the relationships between the adoption of artificial intelligence, the intensity of information technology uses and the performance indicators of startup companies. In order to achieve these objectives, the study applies a quantitative research approach gathering primary data through a structured questionnaire administered to a sample of 50 startup companies operating in Croatia. The data collection was designed to gather detailed information on the extent of AI integration, IT usage patterns and key performance indicators. To analyze the collected data, a correlation analysis was conducted to determine the strength and significance of the relationships between AI adoption, IT usage and business performance variables.

The paper is structured as follows. After the introduction, the first section provides a literature review on the concept of digital entrepreneurship and startups, followed by the research findings on the relationship between the application of AI technologies, business intelligence and startup performance, including the hypotheses put forward. The following section describes the methodology of the study, including data collection, analysis and description of the sample and variables. The next section presents the results of the empirical study conducted, followed by the discussion and conclusions.

2. Literature review

2.1. Digital entrepreneurship and startups

Digital entrepreneurship has emerged as a contemporary theoretical framework that explores the relationship between digital technologies and the entrepreneurial process (Sahut et al. 2021, Giones and Brem 2017, Nambisan 2017). The integration of digital technologies into entrepreneurship changes the process inherently associated with innovation, non-linearity, experimentation, risk-taking, improvisation and effectual logic (Lindholm-Dahlstrand et al. 2019, Duening et al. 2012, Goel and Karri 2006, Sarasvathy 2001). Due to the pervasive impact of digitalization on all economic and social spheres, Ahmad and Ribarsky (2018) emphasize the multidimensional nature of the digital economy and point to issues of clarity and scope in defining this concept. A common, albeit narrow, approach defines the digital economy primarily as the ICT sector, which is included in ISIC Rev. 4. However, this approach overlooks critical components such as intermediary platforms that provide services at little or no cost but form a significant part of digital economy activities. For the purposes of this paper, we adopt the definition of Bukht and Heeks (2017), who define the digital economy as "the part of economic output based solely or primarily on digital technologies, with a business model based on digital goods or services." This broad framework captures the activities of digital startups, which are central to realising the benefits of digital technologies into the economy and society due to their scalability.

The characteristic of scalability of digital businesses is particularly pronounced in the digital economy (Damodaran, 2009, Autio et al., 2018, Ahmad & Ribarsky, 2018, Bukht & Heeks, 2017). Digital companies benefit from lower startup costs, greater market access and the opportunity to connect with potential customers and investors globally. They also have the opportunity to grow and scale quickly through improved customer relationships via social media (OECD/European Union, The Missing Entrepreneurs 2019, van Welsum, 2016). Digital technologies, including artificial intelligence, 3D printing, social media platforms, big data, cloud computing and mobile technologies, not only open up new sources of efficiency in the entrepreneurial process, but also offer extensive opportunities for diverse entrepreneurial activities (von Briel et al., 2018). Digital entrepreneurship is transforming the business landscape through technological advances, offering unique opportunities for startups to drive economic growth, innovation and job creation. These companies are at the center of a broader digital economy and underscore the transformative role of technology in entrepreneurship. Due to their inherent innovative capabilities and high growth potential, startups play a crucial role in economic growth and job creation (Ivanović-Đukić et al., 2019, Steve and Dorf, 2014, Valliere & Peterson, 2009) and are of great interest to policy makers.

The ability to innovate and scale is a key differentiator between startups and other newly founded organizations. In the EU Startup Monitor report (2018), the European Commission highlights the key parameters of startup entrepreneurship, noting that startups generally require significantly more capital to grow than other entities in the small and medium-sized enterprise (SME) sector. In addition, the sources of funding for startups differ from those of SMEs. While SMEs often rely on bank loans, startups typically seek alternative funding sources of financing such as equity, family and friends, business angels or venture capital funds, with bank loans only being considered as a last resort.

Blank (2013) emphasizes that a successful startup must focus on two main objectives: "business model repeatability" (the ability to maintain a sustainable business model that consistently generates profits) and "scalability" (the ability to profitably serve a growing number of customers and improve performance quickly and at low cost). For startups to thrive and contribute to economic growth, the quality and sustainability of the entrepreneurial ecosystem is critical. This ecosystem, shaped by government policy and collaboration with social institutions, creates the necessary environment for digital startups to develop quickly and efficiently. Digital technologies and financial capital from investors play a key role in enabling startups to implement scalable business models, thereby significantly driving economic growth and, especially in the case of internationalization, expanding their reach on a global scale.

Successful startup companies have recognized that the basic requirement for successful and effective computerization of the business system is the connection and integration of information system activities with the company's business activities. In practice, it has been shown that the idea of reducing costs without consolidating and adapting IT solutions and introducing innovations will not solve business problems in the long run (Evello, 2012). Incorporating the investment of IT into the company's development budget, systematic analysis of the specific and synergistic impact of ICT on the business and success of startup companies, and information and close cooperation in the implementation of informatization through project methods and research are the guarantors of successful informatization of startup companies. In this way, it becomes easier to understand the possibilities of using and the impact of information and communication technologies on the achievement of business

goals, such as: cost optimization, productivity increase, business process improvement (Vukmirović, Grčić Fabić, Džido, 2023).

2.2. Artifical intelligence, business intelligence and startup performance

In the contemporary business environment startups are faced with challenges that go beyond traditional information technologies. Information technology surpasses the mere digitization of business and becomes an integral part of the information transformation process in a company. For information technology to truly become a strategic resource for business excellence, it must be integrated into business functions at a higher level and gradually evolve into business technology. In this new role, the goal is no longer just to support operational processes, but to actively enable their existence and development. The transition from the paradigm of information technology (IT) to business technology (BT) is not just a nominal exchange of terms, but marks a profound change in the organizational paradigm. It is a change that is not limited to IT departments and their employees, but systematically affects the entire structure of the organization, from the boards and upper management down to the lowest operational levels. This metamorphosis marks a new way of thinking and acting in which technology becomes inextricably linked to the business strategy and identity of the company (Sesvećan, 2008).

Artificial intelligence (AI) is increasingly taking a central role, not only as a technological tool, but also as a strategic resource that shapes the way startups gather, analyze and use information for decision-making, innovation and achieving competitive advantage (Kudelić et al. 2025, Sestino & De Mauro, 2021). Due to their inherent agility and innovation orientation, startups represent an ideal context for the application of AI technologies. For example, AI technologies enable personalization of the user experience through real-time data analysis, the automation of marketing campaigns and inventory management, process optimization through predictive models or the use of AI chatbots and voice analytics in customer support (Sestino & De Mauro, 2021; Jayabalan, 2024). AI enables better market understanding, predicting consumer needs, identifying business opportunities faster, and innovating products, processes, and market approaches. Startups that use AI have shown a higher likelihood of survival, scaling, and successful market entry (Gomwe et al., 2022; Jayabalan, 2024). According to the research findings of Basri (2020), the application of AI-assisted social media marketing on a sample of startups in Saudi Arabia showed a statistically significant and positive impact on startups' business performance and, in particular, an increased ability to retain users and attract new market segments thanks to personalized approaches based on AI. In addition, the positive impact is reflected in the optimization of knowledge within the company as well as in the reduction of training costs and employee turnover. Technologies such as chatbots and automated targeting have enabled 24/7 customer support and much more precise advertising.

Furthermore, in their systematic quantitative literature review, Mariani et al. (2023) find that artificial intelligence has a positive and multidimensional impact on various types of innovation, such as product innovation (e.g. development of smart products), process innovation (e.g. optimization of real-time operations) and business model innovation (e.g. AI-based platforms). It was also found that AI enables a faster response to market changes through the automation of data analysis and predictive models, thereby shortening the innovation cycle time. Furthermore, AI is gaining recognition as a key catalyst in enhancing the processes through which startups secure financial funding. Recent empirical studies demonstrate that AI integration significantly improves startups' ability to attract funding by enabling sophisticated predictive analytics and real-time optimization of fundraising

campaigns. For instance, a comprehensive study analyzing 556 generative AI startups revealed that technological capabilities combined with investor behaviors critically influence funding success, underscoring AI's role in aligning startup innovation with investor expectations (Siddik et al. 2024). Moreover, the bibliometric study conducted by Kudelić, Šmaguc, and Robinson (2025), which explores the convergence of artificial intelligence, entrepreneurship, and finance, highlights several critical implications for both researchers and practitioners. Notably, the research emphasizes the growing integration of AI within alternative financing mechanisms such as crowdfunding, peer-to-peer lending, and robo-advisory services. Additionally, AI is increasingly employed to support strategic decision-making related to business expansion and new investment opportunities, often through advanced tools like robo-advisors. The study also underscores the potential of combining AI with blockchain technology and smart contracts to enhance the detection and prevention of financial fraud, addressing persistent challenges in auditing and financial reporting. Lastly, it points to the accelerated development of predictive analytics as a vital component in entrepreneurial business planning, enabling more informed and forward-looking strategies.

Sreenivasan and Suresh (2022) in their review of the literature on the use of artificial intelligence in startups emphasize how AI can improve the IT infrastructure of startups, enabling them to adapt more quickly to market changes and improve business processes. The increasing integration of AI technologies into the day-to-day business operations of startups, including IT infrastructure, product development and customer support, indicates a general increase in agility and operational efficiency through the increasing and intensive application of information technologies. The role of business intelligence (BI) in modern organizations, especially startups, is becoming increasingly prominent due to its ability to collect, integrate and multidimensionally analyze data from various sources – from users, markets, competitors to the corporate environment. AI enables a radical improvement of conventional business intelligence (BI) systems, which often reach their limits when working with large, complex and diverse data sets. By integrating machine learning, natural language processing and predictive analytics methods, AI transforms BI into a proactive system that enables real-time prediction of market trends, automated reporting and decision-making (Jayabalan, 2024; Huang et al. 2022).

While this study primarily highlights the positive correlations between AI adoption and startup performance, it is important to acknowledge that the implementation of AI technologies also entails significant challenges and potential negative consequences. Startups often face barriers such as high initial costs, lack of skilled personnel, and integration complexities, which can hinder effective AI deployment (Dwivedi et al., 2021). Moreover, ethical concerns related to data privacy, algorithmic bias, and transparency pose risks that may affect stakeholder trust and regulatory compliance (Kudelić et al. 2025, Raji et al., 2020). A balanced understanding of AI's role in startups requires not only recognizing its benefits but also critically engaging with these limitations and risks. Accordingly, future research should explore strategies to mitigate such challenges, including ethical AI design and scalable implementation models tailored to startup contexts.

Business Intelligence (BI) and Artificial Intelligence (AI) are two revolutionary technologies that can redefine the decision-making process and strategic planning methodology in every industry sector. A major challenge for business intelligence systems in startups is supporting the rapidly growing volume and complexity of data. The emergence of AI and its advanced algorithms is revolutionizing and complementing existing Big Data (BD) tools and technologies for automating data analysis, generating insights, and making decisions in real

time. The combined use of AI and BD enable BI could help improve existing processes, especially when developing real-world applications in finance, healthcare, logistics, and manufacturing. The synergistic development of AI and BD has great potential for significantly innovative BI, providing automation of data analysis for real-time insights to gain competitive advantages in a data-rich environment (Jayabalan, 2024).
The synergistic use and development of artificial intelligence, big data technology and business intelligence systems provides a transformative opportunity for any company to improve its data analysis process, improve the quality of decisions and its information agility to generate and develop innovations and secure a competitive advantage in the current data age business environment.

3. Methodology

The research used a questionnaire that is methodologically structured to systematically present key factors in the development, use and effects of information and communication technologies in the development of startup companies. The survey results generated information on the factors of development, use and effects of systematically related methods, concepts and technologies of digital entrepreneurship, and the performance of startup companies. The information was also useful in the realization of business goals and support for the achievement of planned business effects. All survey participants were provided with detailed research results in order to gain new insights into digital entrepreneurship.
The research on factors in startup companies collected data from 50 startup companies in Croatia. Each respondent represented one startup company. As far as the structure of respondents is concerned, 27 general managers of startup companies, 8 founders, 7 heads of departments and 5 IT employees participated in the survey The interrelationship of artificial intelligence, and the business effects of startup companies is analyzed. The research is designed as an empirical research which tries to investigate the relationship between independent variables (Artificial Intelligence) and the dependent variables (Business Intelligence and Company's performance). The variables are measured using a 5-point Likert scale. The study used theoretical and practical research methods, including literature reviews, surveys, interviews, and observations. When completing the survey, participants could express their own suggestions and opinions or leave questions unanswered.

The aim of the study is to explore the relationship of artificial intelligence (AI) and the performance of startup companies. Also, based on previous research results and data from the literature, the impact of artificial intelligence on business intelligence in the context of the impact on the performance of startup companies is investigated.

The researche objective is: to investigate the connection (relationship) between artificial intelligence and the performance of startup companies. In accordance with the subject of the research, the following research objectives have been set:

- To investigate the relationship between artificial intelligence and performance of startup companies
- To investigate the relationship between artificial intelligence and sucess of startup companies
- To investigate the direct connection between artificial intelligence and startup companies
- To investigate the impact of artificial intelligence on business intelligence in startup companies

- To investigate the synergistic impact of artificial intelligence and big data technology on business intelligence
- To investigate the impact of business intelligence on the performance of startup companies
- To investigate the indirect connection of artificial intelligence through business intelligence on startup companies.

In accordance with the defined research objective, the hypotheses are formulated as follows
H1: Artificial intelligence significantly affects the performances of startups.
H2: There is a statistically significant difference in the use of artificial intelligence between startups that perform better than startups that perform wors
H3: Artificial intelligence has a very significant influence on the business intelligence in startup companies.
H4. There is a strong correlation between business intelligence and performances in startup companies.

In the research of correlation betwen AI ad performance in startup company, the following question was set: Evaluate at what level you use Artifficial Intelligence (AI) in your company. The variables are measured using 5 points Likert scale. Accordingly, the answer options are offered:
1. AI is not used at all and the possibility of their introduction is not being considered.
2. AI is not used, but is in the phase of introduction.
3. Partially used.
4. AI is intensively used at the level of individual business functions and processes.
5. AI is intensively used at the level of the entire (integrated) business process.

The research defined the potential business performance of startup companies. The question was: Evaluate (rate) the business performance of your company
1 – The performance is not significant.
2 – The performance was not achieved
3 – The performance was partially achieved
4 – The performance was largely achieved
5 - The performance was fully achieved

Statistical methods of hypothesis testing and correlation analysis were used in the study. Statistical methods of hypothesis testing were used to investigate the influence of artificial intelligence on the business profit and credit rating of startup companies. The statistical significance of the difference between the arithmetic means of the first and second groups of startup companies at the significance level of 1% was tested. Based on the performance indicators of startup companies, two groups were formed: group 2, which includes startup companies that operate with a positive profit and whose credit rating is greater than or equal to AA, and group 1, which includes other companies. The data on the company's performance, business profit and credit rating was collected from sources: 1) Info.BIZ, 2) CompanyWall and 3) InSolve.

Correlation analysis presents the relevant relationships between the artificial intelligence, the factors of information and communication technologies (ICT) and business effects of startup companies na temelju podataka prikupljenih anketnim upitnikom. Pearson's correlation coefficient have been calculated by SPSS. According to Petz (2004.), Fein (2021.) Demeusy (2023.) we use following scale of Pearson's Correlation Coefficient: Not correlated (0–0,10),

Weak (0,10–0,30), Weak to Moderate (0,30-0,40), Moderate (0,40-0,50), Moderate to Strong (0,50-0,60), Strong (0,60-0,80) and Very strong (0,80-1). Moderate correlation indicates a noticeable relationship between two variables, suggesting a connection that is evident but not overly strong (Wisdom Library, 2025). Strong correlation in scientific studies refers to a significant statistical relationship between two variables, suggesting that changes in one variable may influence changes in another. Weak correlation indicates a minimal relationship between two variables, meaning changes in one do not reliably predict changes in the other.

4. Research results

Based on the performance indicators of startup companies, two groups were formed: group 2, which includes startup companies that operate with a positive profit and whose credit rating is greater than or equal to AA, and group 1, which includes other companies. Table 1 shows data on the sample structure, mean values, standard deviation and standard error.

Table 1: Group Statistics of the influence of Artifficial Intelligence and Profitability startup companies

	Profitability Group	**N**	**Mean**	**Standard Deviation**	**Standard Error**
Influence of Artifficial Intelligence (AI)	1	30	2,2333	1,43078	0,26122
	2	20	3,4000	1,39170	0,31119

Source: Authors

Table 2 shows the results of the Levene's test and the T-test. Levene's test is used to calculate the assumption of homogeneity of variance. The result of the Levene's test (Sig. > 0.05) shows that the variances are homogeneous, therefore Table 2 shows the results of testing the hypothesis on the difference of the arithmetic means in the row EV n.a. (Equal variances assumed). The table shows that the results of the T-test on testing the hypothesis about the difference between the arithmetic means of the Artifficial Intelligence level of usage with regard to the success of startup companies (Sig. < 0.01) show that Artifficial Intelligence significantly influences the success of startup companies at the 1% level.

Table 2: T-test results for the influence of Artifficial Intelligence and Profitability of startup companies

	Levene s test		**T-test 99% Confidence Interval of the Difference**		
EV assum.	F	Sig.	t	df	Sig. (2- t)
EV n.a.	0,060	0,808	2,855	48	0,006
			2,871	41	0,006

Source: Authors

Skewness and Kurtosis tests of normality of distribution were conducted for the artificial intelligence variable. The results are shown in Figure 1.

Figure 1: Skewness and Kurtosis test od distribution normality

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
VAR00001	50	1,00	5,00	2,7000	1,51523	,279	,337	-1,396	,662
Valid N (listwise)	50								

Source: Authors

Skewness value is between -1 and 1, while Kurtosis value has slight deviation that indicates distribution normality.

There are calculated correlations and significance of correlations in the analysis of the connection between artificial intelligence and business performance of startup companies based on data from the survey questionnaire. Correlations at the 5% statistical significance level are marked with an asterisk, and correlations at the 1% significance level are marked with two asterisks. Based on the Pearson correlation coefficient scale, moderate correlations are marked with a dash, and strong correlations are marked with bold. Table 3 shows the calculated values and meanings of correlations that show the level of influence of artificial intelligence on the performance of startup companies

Table 3: Correlation Analysis of Artifficial Intelligence the performances of startup companies

No.	Performances of startup companies	Abb	Corr.	Sig.	N
1	Maximizing profits	PRO	0,40**	,006	47
2	Design and development of innovations	IND	0,29*	,045	47
3	Creating a competitive advantage	ADC	0,31*	,033	48
4	Realized innovations	INR	0,33*	,026	46

Source: Authors

The table shows that there is a moderate correlation between artificial intelligence and profit maximization at the 1% significance level. Since the results of the hypothesis testing (Table 2) also show the correlation of artificial intelligence and the profitability of startup companies at the 1% significance level, it can be concluded that artificial intelligence is significantly correlated with profitability of startup companies.

The calculated correlation between artificial intelligence, competitive advantage and innovation implementation is at the level of weak to moderate correlation, which indicates that the impact of artificial intelligence is weak, but has the potential to strengthen given the trends in the development and use of artificial intelligence in the business of startup companies. A weak correlation between artificial intelligence and the design of innovations at the 5% significance level was also calculated, which does not prove a significant correlation and indicates a possible potential relationship.

The use of artificial intelligence as a technology for the processing and strategic analysis of large amounts of data enables the creation of information and knowledge in the business

intelligence system, which are key to the development of innovations, the creation of competitive advantage and decision-making. In this context, a regression analysis of the impact of artificial intelligence and big data technology on business intelligence was used, that is shown in Figure 2.

Figure 2: Synergistic Influence of Artifficial Intelligence and Big Data on Business Intelligence in startup companies

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,898[a]	,807	,798	,61608

a. Predictors: (Constant), Artifficial_Intelligence, Big_Data

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	69,853	2	34,926	92,020	,000[a]
	Residual	16,700	44	,380		
	Total	86,553	46			

a. Predictors: (Constant), Artifficial_Intelligence, Big_Data

b. Dependent Variable: Business_Intelligence

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,080	,211		,380	,706
	Big_Data	,585	,074	,617	7,865	,000
	Artifficial_Intelligence	,371	,072	,402	5,130	,000

a. Dependent Variable: Business_Intelligence

Source: Authors

The Figure shows that the calculated correlation coefficient is 0.898 and the significance of the correlation for the variables - Artificial Intelligence and Big Data. This shows that there is a very strong synergistic influence of Artificial Intelligence and Big Data on Business Intelligence. Following the above, the impact of artificial intelligence on the performance of startup companies is analyzed.

Table 4 shows the Correlation between Business Intelligence (BI) and performances of startup companies.

Table 4: Correlation between Business Intelligence (BI) and performances of startup companies.

No.	Performances of startup companies	Abb	Corr.	Sig.	N
1	Maximizing profits	PRO	,390**	,006	48
2	Minimizing costs	COS	,373**	,008	49
3	Identifying business opportunities in the market	BOM	,351*	,013	49
4	Design and development of innovations	IND	,477**	,001	49
5	Creating a sustanaible competitive advantage	ADC	,553**	,000	49
11	Increased ability to partner or integrate systems with other companies	INT	,446**	,001	48
13	Improved efficiency and productivity	EFF	,342*	,016	49
14	Realized innovations	INR	,571**	,000	48
15	Better communication and cooperation with business partners	BPC	,434**	,002	47

Source: Authors

A moderate to strong correlation showing a significant impact of artificial intelligence was calculated for the performances: Creating a sustainable competitive advantage and Realized innovations. A moderate to strong correlation showing a significant impact of artificial intelligence was calculated for the performances: Creating a sustainable competitive advantage and Realized innovations. A weak to moderate correlation was calculated for the variables Maximizing profits and Minimizing costs. A moderate correlation between artificial intelligence and startup performance was calculated for the following performances: Design and development of innovations, Increased ability to partner or integrate systems with other companies, Improved efficiency and productivity, Realized innovations.

5. Discussion and Conclusion

Statistical methods of hypothesis testing, correlation analysis and regression analysis were used in the research of the role and impact of artificial intelligence on information technology and startup performance. In the research of the impact of artificial intelligence on business performance based on the financial data of startups, the hypothesis testing method was used that confirmed the main hypothesis at the 1% significance level. Correlation analysis methods were used in the study of the impact of artificial intelligence on startup performance. A moderate correlation between artificial intelligence and profitability was determined at the 1% significance level. A weak to moderate correlation at the 5% significance level was determined for the impact on creating sustainable competitive advantage and implementing innovations. A weak correlation was determined between artificial intelligence and designing inovations.

In the study of the impact of artificial intelligence on information technologies, correlation analysis and regression analysis methods were used. The correlation analysis method determined a strong impact of artificial intelligence on business intelligence (0.74). The regression analysis method determined a very strong synergistic impact of artificial intelligence and big data technologies (0.90). Given the very strong impact of artificial

intelligence on business intelligence, it can be concluded that artificial intelligence also indirectly affects the performance of startup companies through business intelligence. In this context, the correlations between business intelligence and startup company performance were analyzed. Using the correlation analysis method, a moderate correlation between artificial intelligence and startup performance was calculated, calculated for the following performances: Design and development of innovations, Increased ability to partner or integrate systems with other companies, Improved efficiency and productivity, Realized innovations. A moderate to strong correlation showing a significant impact of artificial intelligence was calculated for the performances Creating a sustainable competitive advantage and Realized innovations

Based on the research results, it can be concluded that artificial intelligence has a significant impact on startup performances, that confirms the main research hypothesis. The auxiliary research hypotheses were also confirmed. The correlations and significance of the correlations between artificial intelligence, information technologies and startup performances were calculated. The research results show that artificial intelligence has strong impact on the way in which information technologies are used in startup companies and that the development, use and impact of information technologies are raised to a higher level. Future work should explore the possibilities of developing and using new combinations of artificial intelligence and information technologies in achieving startup performances. A key limitation of this study is the relatively small sample size of 50 startup companies, which, while methodologically justified given the exploratory nature of the research and the specific context of Croatian startups, inherently restricts the extent to which the findings can be generalized to the broader population of startups globally. Furthermore, as the study employs correlational analysis, results should be interpreted as indicative of associations rather than causal relationships. Future research should aim to replicate and extend these findings using larger and more diverse samples across different geographic and industry contexts to enhance external validity and enable more generalized inferences.

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REFERENCES

Adekunle, O. K., Ologbon, E. G., Abiodun, S. J. (2024): ***Artificial Intelligence (AI) Adoption and Startup Success Rates***, International Journal of Research and Innovation in Social Science, International Journal of Research and Innovation in Social Science, 8 (11), 3032-3043. https://dx.doi.org/10.47772/IJRISS.2024.8110235

Ahmad N, Ribarsky J (2018): ***Towards a Framework for Measuring the Digital Economy.*** Paper presented at 16th Conference of the International Association of Official Statisticians (IAOS), Paris, France, 19-21 September 2018

Al-Momani, M. M., (2024): ***Maximizing Organizational Performance: The Synergy of AI and BI***. Revista De Gestão Social E Ambiental, 18(5), e06644. https://doi.org/10.24857/rgsa.v18n5-143

Autio, E., Nambisan, S., Thomas, L. D., Wright, M. (2018): ***Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems***, Strategic Entrepreneurship Journal, Vol. 12, No. 1, pp. 72-95., DOI: 10.1002/sej.1266

Basri, W. (2020): ***Examining the Impact of Artificial Intelligence (AI)-Assisted Social Media Marketing on the Performance of Small and Medium Enterprises: Toward Effective Business Management in the Saudi Arabian Context***. Int J Comput Intell Syst 13, 142–152. https://doi.org/10.2991/ijcis.d.200127.002

Blank, S. (2013): ***Why the Lean Start-up changes everything***. Harvard Business Review.

Bukht R, Heeks R (2017): ***Defining, Conceptualising and Measuring the Digital Economy***. Development Informatics Working Paper no. 68. Centre for Development Informatics, Global Development Institute, SEED, University of Manchester

CompanyWall Business – Bonitetne informacije tvrtki, 2025. https://www.companywall.hr

Damodaran, A. (2009): ***Valuing Young Start-Up and Growth Companies: Estimation Issues and Valuation Challenges***, New York: Stern School of Business New York University

Davenport, T., Guha, A., Grewal, D., Bressgott, T., (2020): ***How artificial intelligence will change the future of marketing***. J. of the Acad. Mark. Sci. 48, 24–42 (2020). https://doi.org/10.1007/s11747-019-00696-0

Demeusy, A. (2023): ***Pearson Correlation: Methodology, Limitations & Alternatives—Part 1: Methodology***, Medium, San Francisco, CA https://medium.com/@anthony.demeusy/pearson-correlation-methodology-limitations-alternatives-part-1-methodology-42abe8f1ba90

Duening, T., Shepherdet, M. M., Czaplewski, A. J. (2012): ***How Entrepreneurs Think: Why Effectuation and Effectual Logic May be the Key to Successful Enterprise Entrepreneurship***, International Journal of Innovation Science 4(4), 205-216, DOI: 10.1260/1757-2223.4.4.205

Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., Duan, Y., Dwivedi, R., Edwards, J., Eirug, A., Galanos, V., Ilavarasan, P. V., Janssen, M., Jones, P., Kar, A. K., Kizgin, H., Kronemann, B., Lal, B., Lucini, B., Medaglia, R., Le Meunier-FitzHugh, K., Le Meunier-FitzHugh, L. C., Misra, S., Mogaji, E., Sharma, S. K., Singh, J. B., Raghavan, V., Raman, R., Rana, N. P., Samothrakis, S., Spencer, J., Tamilmani, K., Tubadji, A., Walton, P., & Williams, M. D. (2021): ***Artificial intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy***. International Journal of Information Management, 57, 101994. https://doi.org/10.1016/j.ijinfomgt.2019.08.002

Ebule, A. E. (2025): ***Leveraging Artificial Intelligence in Business Intelligence Systems for Predictive Analytics***, International Journal of Scientific Research and Management (IJSRM), 13 (1), 1862-79. https://doi.org/10.18535/ijsrm/v13i01.ec02.

Evello d.o.o (2012): ***IT consulting & business services, Na koji način uskladiti IT i poslovanje?*** http://www.evello.hr/default.aspx?id=55

EU Startup Monitor 2018, European Commission (2018): http://startupmonitor.eu/EU-Startup-Monitor-2018-Report-WEB.pdf (Accessed 20 Sept 2022).

Fein, E. C., et.al. (2021): ***Statistics for Research Students***, University of Southern Queensland, Toowoomba, 2021.

Giones, F., & Brem, A. (2017): ***Digital Technology Entrepreneurship: A Definition and Research Agenda***, Technology Innovation Management Review, Vol. 7 (5), 44-51. https://ssrn.com/abstract=2984542

Goel, S., Karri, R. (2006): ***Entrepreneurs, Effectual Logic, and Over–Trust, Entrepreneurship Theory and Practice***, 30, (4), https://doi.org/10.1111/j.1540-6520.2006.00131.x

Gomwe, G., Potgieter, M., & Litheko, A. M. (2022): ***Proposed Framework for Innovative Business Intelligence for Competitive Advantage in Small, Medium and Micro-Organisations in the North West Province of South Africa***. Southern African Journal of Entrepreneurship and Small Business Management, 14(1).

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022): ***A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) (3 ed.)***. Thousand Oaks, CA: Sage.

Huang, Z., Savita, K.S., Zhong-jie, J. (2022): ***The Business Intelligence impact on the financial performance of start-ups***, Information Processing & Management, 59 (1), https://doi.org/10.1016/j.ipm.2021.102761

InfoBiz, informacije o uspješnosti poslovanja i financijskom položaju poslovnih subjekata u Hrvatskoj, (2025): https://infobiz.fina.hr

InSolve, izvor financijskih i poslovnih informacija, (2025), https://www.insolve.hr/

Ivanović-Đukić, M., Stevanović, T., Rađenović, T. (2019): ***Does digitalization affect the contribution of entrepreneurship to economic growth?*** Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu/Proceedings of Rijeka Faculty of Economics: Journal of Economics and Business, Vol. 37, No. 2, pp. 653-679.

Jayabalan, D. (2024): ***Business Intelligence to Artificial Intelligence***. International Research Journal of Modernization in Engineering Technology and Science, 6(5).

Judijanto, L., Utama, I. W. K., Ambarita, N. P., Permana, I. (2023): ***An Interdisciplinary Bibliometric Review of the Symbiotic Relationship between Business Intelligence and Artificial Intelligence***. The Eastasouth Journal of Information System and Computer Science, 1(02), 98–108. https://doi.org/10.58812/esiscs.v1i02.183

Kudelić, R., Šmaguc, T., Robinson, S. (2025): ***Artificial intelligence in the service of entrepreneurial finance: knowledge structure and the foundational algorithmic paradigm***. Financ Innov 11, 72. https://doi.org/10.1186/s40854-025-00759-y

Lindholm-Dahlstrand, Å, Andersson, M., and Carlsson, B. (2019): ***Entrepreneurial experimentation: a key function in systems of innovation***. Small Bus. Econ. 53, 591–610. doi: 10.1007/s11187-018-0072-y

Mariani, M. M., Machado, I., Nambisan, S. (2023): ***Types of innovation and artificial intelligence: A systematic quantitative literature review and research agenda***, Journal of Business Research, Elsevier, vol. 155(PB).

Nambisan, S. (2017): ***Digital Entrepreneurship: Toward a Digital Technology Perspective of Entrepreneurship.*** Entrepreneurship Theory and Practice, 41(6), 1029–1055. https://doi.org/10.1111/ETAP.12254

OECD/European Union, The Missing Entrepreneurs (2019): ***Policies for Inclusive Entrepreneurship, what potential does digital entrepreneurship have for being inclusive?*** Paris: OECD Publishing

Petz, B. (2007): ***Osnovne statističke metode za nematematičare***, Naklada Slap, Jastrebarsko

Raji, I.D., Smart, A., White, R.N., Mitchell, M., Gebru, T., Hutchinson, B., Smith-Loud, J., Theron, D., & Barnes, P. (2020): ***Closing the AI accountability gap: defining an end-to-end framework for internal algorithmic auditing.*** Proceedings of the 2020 Conference on Fairness, Accountability, and Transparency.

Sahut, J. M., Dana, L. P., & Teulon, F. (2021): ***Corporate governance and financing of young technological firms: A review & introduction***. Technological Forecasting and Social Change, 163, 120425. https://doi.org/10.1016/J.TECHFORE.2020.120425

Sarasvathy, S. D. (2001): ***Causation and Effectuation: Toward a Theoretical Shift from Economic Inevitability to Entrepreneurial Contingency***. https://Doi.Org/10.5465/Amr.2001.4378020, 26(2), 243–263

Schulte-Althoff, M., Fürstenau, D., Moo Lee, G. (2021): ***A Scaling Perspective on AI Startups***. In Proceedings of the 54th Hawaii International Conference on System Sciences (pp. 6515-6524). Hawaii International Conference on System Sciences (HICSS). https://doi.org/10.24251/HICSS.2021.784

Sestino, A., De Mauro, A. (2021): ***Leveraging Artificial Intelligence in Business: Implications, Applications and Methods***. Technology Analysis & Strategic Management.

Sesvećan, V. (2008): ***Sve će više informatičara postajati glavni direktori,*** Poslovni dnevnik, Zagreb, https://www.poslovni.hr/svijet/sve-ce-vise-informaticara-postajati-glavni-direktori-85153

Siddik, A.B., Li, Y., Du, A. M. (2024): ***Unlocking funding success for generative AI startups: The crucial role of investor influence***, Finance Research Letters, 69. https://doi.org/10.1016/j.frl.2024.106203.

Sreenivasan, A., Suresh, M. (2022): ***Adoption of Artificial Intelligence (AI) in Start-ups: A Review***, Proceedings of the 2nd Indian International Conference on Industrial Engineering and Operations Management, Warangal, India, 2022.

Steve, B., Dorf, B. (2014): ***The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company***, K&S Ranch

Usman, F. O., Eyo-Udo, N. L., Etukudoh, E. A., Odonkor, B., Ibeh, C. V., & Adegbola, A. (2024): ***A critical review of ai-driven strategies for entrepreneurial success***. International Journal of Management & Entrepreneurship Research, 6 (1), 200-215.

Valliere, D., Peterson, R. (2009): ***Entrepreneurship and economic growth: Evidence from emerging and developed countries***, Entrepreneurship & Regional Development, Vol. 21, No. 5-6, pp. 459–480., DOI: 10.1080/08985620802332723

van Welsum, D. (2016): ***Enabling Digital Entrepreneurs***, World Development Report 2016, Background Paper, World Bank Group

von Briel F, Davidsson P, Recker J. (2018): ***Digital Technologies as External Enablers of New Venture Creation in the IT Hardware Sector***. Entrepreneurship Theory and Practice 1–23:47-69. https://doi.org/10.1177/1042258717732779

Vukmirović, S., Grčić Fabić M., Džido, A. (2023): ***Analysis of the factors of informatization and digital entrepreneurship in the development of startup companies in Croatia***. Interdisciplinary Management Research (IMR) XIX. Osijek: Josip Juraj Strossmayer University of Osijek, Faculty of Economics in Osijek

Wisdom Library (2025): ***Significance of Moderate correlation***, https://www.wisdomlib.org/concept/moderate-correlation

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DEVELOPMENT

A scientific paper

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MERCHANDISE EXPORTS AND PRODUCTIVITY IN MANUFACTURING THROUGH THE LENS OF TECHNOLOGICAL STRUCTURE: THE CASE OF CROATIA

ABSTRACT

This paper explores the sophistication of exports and productivity within the Croatian manufacturing sector, focusing on its technological structure, observed through research and development (R&D) intensity. International composite indicators suggest that Croatian merchandise exports are less sophisticated compared to those of peer economies, making Croatia as an interesting case. Due to the constraints of a small domestic market, the country is compelled to pursue economic growth primarily through export activities. From a policy perspective, industries that generate higher value added and/or exhibit dynamic productivity growth are particularly desirable. Investments in R&D and technologies typically result in high value-added outputs. Industries are categorized by R&D intensity into four groups: high-tech, medium high-tech, medium low-tech, and low-tech. This paper addresses the following research questions: How does Croatia's manufacturing technology structure and export sophistication compare to similar and more advanced economies? Are industries with higher R&D intensity associated with greater productivity, a determinant of competitiveness? These questions are examined using quantitative data from various sources, including Eurostat and national statistics, through descriptive statistics and comparative analysis. The results are compared with selected post-transition Central and Eastern European countries, as well as Croatia's principal European Union trading partners. The findings contribute to a better understanding of how technological structure influences manufacturing productivity and export sophistication in a small, post-transition EU economy. The insights may inform policymakers and industry stakeholders in designing effective industrial and innovation policies by clarifying the link between technological structure and competitiveness.

Key words: *manufacturing, R&D, technological structure, productivity, export sophistication.*

1. Introduction

Small economies are constrained by the limited size of their domestic markets, which hinders their ability to achieve efficient production scales. This limitation can be mitigated by competing in foreign markets, i.e. through exports. Contemporary economic development and growth challenges increasingly require economies to generate higher volumes of high value-added merchandise exports, often linked to technologically advanced and highly innovative industries. Post-transition economies in the European Union are developing at varying speeds, depending on factors such as investment volume, innovation activity, integration into global value chains, and national economic strategies. Croatia was the last post-transition country to join the EU in 2013 as a small economy with a stagnating manufacturing sector undergoing

deindustrialisation and a growing reliance on tourism. Previous papers have identified Croatia's manufacturing technological structure as outdated and less competitive in export markets (Rašić – Bakarić, Vizek, 2010). Merchandise exports were found to be comparatively low in value (Buturac, 2017) and dominated by standardised products vulnerable to price issues (Stojčić, Bačić, Aralica, 2015). Importantly, the transition toward higher value-added export products is considered a prerequisite for improving export competitiveness (Buturac, 2009). The most recent international composite indicators reflect Croatia's slow progress and stagnation relative to its peers.

To the best of the author's knowledge, there is a lack of recent research on the technological structure of the Croatian manufacturing sector. This paper aims to examine the economic outcomes produced by this structure, primarily through export indicators and labour productivity. It addresses the following research questions: What is the current state of Croatia's manufacturing technology structure? How does this structure—and the sophistication of Croatian exports—compare with those of similar or more advanced economies? Are industrial groups characterised by higher R&D intensity also associated with greater productivity, a determinant of competitiveness? These questions are examined using quantitative data from multiple sources, including Eurostat and national statistics, through descriptive statistics and comparative analysis. Results are compared with those of post-transition Central and Eastern European countries and several of Croatia's key EU trading partners. The paper contributes to a deeper understanding of how the technological structure of manufacturing determines productivity and export sophistication in a small post-transition EU economy. The findings may be of importance to policymakers and industry stakeholders in shaping policies that aim to enhance manufacturing competitiveness.

The paper is structured as follows: after this introduction, a theoretical and empirical overview is presented, followed by the methodological framework and the analysis of results. The paper concludes with a summary of key findings.

2. Theoretical and Empirical Overview

Croatia, along with other EU post-transition economies, is classified as a high-income country according to World Bank standards (World Bank Report, 2024). However, within the context of post-transition Europe, it is not among the leading economies. Key economic indicators reveal that countries with similar initial conditions—such as Czechia, Slovenia, and Hungary—have outperformed Croatia. As a macroeconomic measure of productivity, gross domestic product (GDP) per capita at market prices provides a relevant point of comparison: in 2024, GDP per capita stood at €29,280 in Czechia and €31,490 in Slovenia, the most advanced among post-transition economies. Croatia recorded €21,710, a figure closely aligned with those of Poland (€22,410) and Hungary (€21,470), according to Eurostat data (2025).

International composite indicators, which capture multiple dimensions of competitiveness, offer further insights. The Economic Complexity Index (ECI) by the Observatory of Economic Complexity (OEC) measures the knowledge intensity of an economy. In 2023, Croatia ranked 34th, while peer post-transition countries achieved significantly higher positions: Czechia ranked 7th, Slovenia 12th, Hungary 14th, Slovakia 15th, and Poland 24th. Over the past two decades, Croatia's decline in ranking suggests a relative decrease in economic complexity (OEC, 2025). A similar pattern is observed in OEC-ECI indicators measuring technological complexity and research.

A substantial portion of Croatia's value added originates from tourism and related sectors. Combined with EU-funded infrastructure projects, this has largely spurred construction activity. However, the corresponding demand has been met predominantly by low-technology manufacturing sectors (e.g., food processing, furniture production) and medium-low-technology industries (e.g., construction materials and inputs).

The limited industrial development and the absence of a coherent industrial policy during the transition and post-transition periods have been identified as key weaknesses of Croatian manufacturing (Jurčić, 2017). According to Jurčić, the transition to a modern, market-oriented industry was never fully implemented, resulting in industrial collapse and a failure to generate high-quality employment—one of the key objectives of industrial development.

The Technological Structure

Structural characteristics of the Croatian manufacturing sector point to a decline in competitiveness and lagging performance compared to other European countries. Between 2002 and 2007, the expansion of low-technology industries was identified as an unfavourable trend (Rašić–Bakarić, Vizek, 2010). Similarly, based on International Trade Centre data, between 2005 and 2010, Croatia's manufacturing exports were dominated by traditional, labour- and resource-intensive sectors such as wood and leather products (Basarac, Vučković, 2011).

While data up to 2018 indicate progress in many low- and medium-complexity sectors, little advancement has been made in high-complexity sectors, except for a notable breakthrough in the chemical and pharmaceutical sector (Pugliese, Tacchella – EC/JRC, 2021). Although Croatia has shown some improvement in economic complexity, it lags behind comparable economies. In the Harvard Growth Lab's 2025 economic complexity ranking, Croatia fell from 30th place in 1995 to 32nd in 2023, while Slovenia, Czechia, Hungary, and Slovakia climbed to 8th, 10th, 13th, and 20th positions, respectively. The economic complexity is observed through the diversity and complexity of country's export basket. This technological lag was already evident in earlier data from UN Comtrade (2015), which showed Croatia's per capita exports value of high-tech goods to the EU-28 were significantly below those of other EU transition countries (Buturac, 2017).

Stojčić, Bečić, and Vojinić (2012) explored the role of technological intensity in industry for both Croatia and Slovenia. In Slovenia, industries with higher technological intensity experienced greater export market share, a pattern not observed in Croatia. However, a structural shift has been identified in Croatian exports to the EU-15 market since 2000: the export structure has gradually shifted from low- to high-technology-intensive industries, with trade increasingly dominated by vertical intra-industry exchanges.

Although the small and medium-sized enterprise (SME) export segment in manufacturing is narrower, all Croatian SME technology sectors recorded improved international competitiveness between 2006 and 2012. These firms generally fit the profile of price-competitive producers of standardised goods. The share of revenue from exports was lowest in the high-tech sector. Nevertheless, improvements in productivity were visible among high-tech firms during this period, which included the global financial crisis, while productivity declined in low- and medium-low-technology groups (Stojčić, Bačić, and Aralica, 2015).

Croatia's unfavourable industrial structure has also been cited by Kersan-Škabić (2017) as one of the reasons for the country's limited share of intermediate goods in exports up to 2011. She also highlighted Croatia's insufficient integration into the EU's single market.

The Manufacturing Export Dynamic and Value Added

Croatia's trade specialisation and comparative advantages during the period from 2000 to 2010 were primarily found in low value-added products, among comparable South-East European economies (Buturac, 2013). Specifically, Croatia's annual export growth rate was lower than that of most EU transition economies during the period 1993–2007, according to Buturac's own calculations (2009) and WIIW data. Using standard trade indicators, he identified structural features of Croatian manufacturing trade: in the prevailing inter-industry trade positive export trends were observed only in labour-intensive and raw material-intensive activities, while intra-industry trade was characterised by low value-added exports. Croatia also recorded a positive trade balance with the EU in low value-added goods between 2002 and 2006 (Buturac and Grižinić, 2009). In a broader regional context up to 2008, Buturac, Lovrinčević, and Mikulić (2011) found that comparative advantages and trade specialisation in Croatia and the wider South-East European region were primarily realised in low value-added goods such as iron and steel, footwear, clothing, and wood.

Nikolić and Miloloža (2018) conducted a comprehensive review of 186 scientific papers published in Croatia between 2007 and 2017 on export-related issues. Among other findings, they concluded that Croatian products were gradually losing their share in international markets.

Determinants of Export Competitiveness

Cost factors have played a critical role for Croatian exporters, particularly between 1999 and 2007, as shown by Stojčić (2012). He confirmed that Croatian exporters are highly cost-sensitive in establishing their international position, primarily relying on cost reductions and gains in labour productivity. Wages emerged as a key issue. Using a dynamic panel system GMM technique on a sample of manufacturing firms, Stojčić, Bečić, and Vojinić (2012) further demonstrated that the export competitiveness of Croatian manufacturers is significantly influenced by labour costs—unlike in Slovenia, where product quality was the primary driver of market share in the EU-15 during the period 2002–2007.

In their research of Croatian small and medium-sized manufacturing enterprises (SMEs) between 2006 and 2012, Stojčić, Bačić, and Aralica (2015) identified accumulated entrepreneurial experience, access to new technologies, and learning-by-exporting as key sources of competitive advantage. Productivity gains were found to strengthen SMEs' international positions. Their conclusions were based on dynamic panel analysis of data from 674 firms sourced from the Amadeus database.

According to Duspara, Knežević, and Turuk (2017), Croatia's competitive position relative to comparable economies (e.g., Slovenia, Hungary) was unfavourable up to 2016/17, based on data from the World Economic Forum, the Global Innovation Index, and the Innovation Union Scoreboard. They identified insufficient innovation capacity and a lack of technological sophistication in production as critical challenges.

International Trade Integration and Manufacturing Structure

Croatia has been the least integrated of all new EU member states into the EU's global value chains (GVCs), while Hungary has shown the highest degree of integration (Kersan-Škabić, 2017). This assessment was based on the share of foreign and domestic value added in gross exports using Trade in Value Added (TiVA) data from the WTO and OECD for the years 1995, 2000, 2005, and 2008–2011.

Tica, Stojčić, and Matić (2023) came to similar findings in a study covering the period 1996–2018, using TiVA data for 23 European countries and 45 industrial sectors. Throughout the entire period, Croatia consistently lagged behind other transition economies in forward integration (i.e., the share of domestic value added embodied in foreign exports). By the end of the observed period, Croatia's backward integration (i.e., the share of foreign value added in domestic exports) remained significantly lower than that of comparable countries.

Export Competitiveness and Technological Complexity During Crises

The Croatian manufacturing sector's resilience was tested during the global financial crisis of 2008 and again in the aftermath of the COVID-19 pandemic. The 2008 crisis had a pronounced negative effect on South-East European countries, including Croatia, as it led to reduced comparative advantages and diminished export competitiveness (Buturac, Lovrinčević, and Mikulić, 2011). Nevertheless, Croatian exports showed resilience, with recovery observed from 2010 to 2015 due to renewed foreign demand and greater domestic export orientation (Buturac, 2017).

In a more recent study, Stojčić (2020) examined the impact of the COVID-19 pandemic on the competitiveness of Croatian manufacturing exporters. Using survey-based data from the World Bank covering 131 manufacturing firms, and applying descriptive statistics and econometric analysis, the study found that revenues of export-oriented firms were affected due to COVID-related disruptions in regional and global supply chains.

Sectoral Issues

Sectoral analysis of economic complexity and industrial competitiveness of Croatia between 2012 and 2018 identified the greatest improvements in low- and medium-complexity sectors such as crops, textile materials, and food (Pugliese, Tacchella – EC/JRC, 2021).

Earlier research, based on data from 2002, 2004, and 2006, has shown that Croatian agricultural and transport equipment sectors were relatively well-positioned within the EU, whereas the chemical industry was stagnating and the textile and clothing sectors' competitiveness was deteriorating (Buturac, Grižinić, 2009).

The Croatian food industry, classified as a low-technology sector, has received the most academic attention due to its size. Buturac and Vizek (2015) analysed the Croatian food industry, which accounted for 24% of total manufacturing output up to 2013, using input-output models and standardized export competitiveness indicators. They found that the sector was highly resilient to the 2008 recession, although its product and market structures lacked diversification. Its export performance was strongest in the CEFTA market, where most products had comparative advantages. In a follow-up analysis, Buturac (2018) applied similar methods and confirmed these findings using CBS, UN COMTRADE, Eurostat, and IMF data

up to 2015/16. While Croatia held its position in the CEFTA market, it underperformed in faster-growing markets.

Lessons from the Literature

Previous research consistently shows that Croatian manufacturing exports are predominantly limited to low-value products and that the sector suffers from an unfavourable industrial structure and limited integration into GVCs. The export-oriented segment of Croatian manufacturing demonstrated greater resilience following the 2008 crisis due to the recovery of global trade, although the broader Croatian economy remained weakened for longer. Several authors have highlighted the consequences of Croatia's industrial profile, including a low share of domestically produced intermediate goods in exports and a reliance on standardised, low-value products. Price competitiveness has repeatedly emerged as a serious factor for exporters. Moreover, some researchers argue that the lack of prioritisation of modern industrial development has contributed to the sector's regression.

3. Methodological Framework

This paper relies on descriptive statistical and comparative analysis. Macroeconomic, sectoral, and foreign trade data from various sources were used and adjusted by the author for purposes of comparability. The primary sources include the Financial Agency (FINA), Eurostat, and the Croatian Bureau of Statistics (CBS). FINA provides structural statistics for several European countries, based on Eurostat data, including technological groupings of manufacturing activities according to R&D intensity for the 2016–2020 period. Eurostat data used in this paper include macroeconomic indicators such as the real effective exchange rate (REER), foreign trade data, and statistics on high-technology and medium-high-technology sectors, available up to 2023.

CBS data on Croatian foreign trade, along with other statistical data pertaining to the economy of the Republic of Croatia, are also used in this paper. Most of these data are available up to 2024.

The comparative analysis is carried out for a selected group of countries with economic indicators most relevant to the research questions. The country sample includes Croatia's principal trading partners—a few older EU members, post-transition EU economies from the same geographical region and/or with similar pre-transition conditions, as well as one non-EU member. The countries included in the analysis are Croatia, Austria, Germany, Italy, Czechia, Slovenia, Slovakia, Hungary, Poland, Bulgaria, Romania, and Serbia.

Given the focus of this paper on exports in the manufacturing sector, the definition of technology-related aggregates within manufacturing is particularly relevant. The classification of industries by research and development (R&D) intensity, as defined by the OECD (measured as the ratio of R&D expenditure to value added), is also employed by Eurostat for EU member states. Industries are categorised into four technological groups: high-technology, medium-high-technology, medium-low-technology, and low-technology. These classifications are based on the NACE Rev. 2 framework, either at the two-digit or three-digit level, depending on the classificational depth of the data. The scope of these technology-related aggregates is summarised in Table 1 and has been applied accordingly to the various data sources used throughout this paper.

Table 1: Eurostat aggregation of the manufacturing industry according to technological intensity and based on NACE Rev. 2

	Based on NACE Rev. 2, two-digit level		**Based on NACE Rev. 2, three-digit level**
	High-technology		**High-technology**
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations;	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations;
26	Manufacture of computer, electronic and optical products	26	Manufacture of computer, electronic and optical products;
		30.3	Manufacture of air and spacecraft and related machinery
	Medium-high-technology		**Medium-high-technology**
20	Manufacture of chemicals and chemical products;	20	Manufacture of chemicals and chemical products;
27	Manufacture of electrical equipment;	25.4	Manufacture of weapons and ammunition;
28	Manufacture of machinery and equipment n.e.c.;	27	Manufacture of electrical equipment;
29	Manufacture of motor vehicles, trailers and semi-trailers;	28	Manufacture of machinery and equipment n.e.c.;
30	Manufacture of other transport equipment	29	Manufacture of motor vehicles, trailers and semi-trailers;
		30 (ex. 30.1., 30.3)	Manufacture of other transport equipment excluding Building of ships and boats and excluding Manufacture of air and spacecraft and related machinery;
		32.5	Manufacture of medical and dental instruments and supplies
	Medium-low-technology		**Medium-low-technology**
19	Manufacture of coke and refined petroleum products;	18.2	Reproduction of recorded media;
22	Manufacture of rubber and plastic products;	19	Manufacture of coke and refined petroleum products;
23	Manufacture of other non-metallic mineral products;	22	Manufacture of rubber and plastic products;
24	Manufacture of basic metals;	23	Manufacture of other non-metallic mineral products;
25	Manufacture of fabricated metals products, except machinery and equipment;	24	Manufacture of basic metals;
33	Repair and installation of machinery and equipment	25 (ex. 25.4)	Manufacture of fabricated metal products, except machinery and equipment excluding Manufacture of weapons and ammunition;
		30.1	Building of ships and boats;
		33	Repair and installation of machinery and equipment
	Low technology		**Low technology**
10	Manufacture of food products	10	Manufacture of food products;
11	Manufacture of beverages	11	Manufacture of beverages;
12	Manufacture of tobacco products	12	Manufacture of tobacco products;
13	Manufacture of textile	13	Manufacture of textiles;
14	Manufacture of wearing apparel	14	Manufacture of wearing apparel;
15	Manufacture of leather and related products	15	Manufacture of leather and related products;
16	Manufacture of woods and of products of wood	16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials;
17	Manufacture of paper and paper products	17	Manufacture of paper and paper products;
18	Printing and reproductions of recorded media	18 (ex. 18.2)	Printing and reproduction of recorded media excluding Reproduction of recorded media;
31	Manufacture of furniture	31	Manufacture of furniture;

	Based on NACE Rev. 2, two-digit level		Based on NACE Rev. 2, three-digit level
32	Other manufacturing	32 (ex. 32.5)	Other manufacturing excluding Manufacture of medical and dental instruments and supplies

Note: ex. stands for excluding.

Source: Eurostat

4. Manufacturing Technological Structure, Labour Productivity, and Export Competitiveness

4.1. Labour Productivity in Manufacturing

Productivity is key to economic competitiveness. Although various productivity measures exist, labour productivity is most commonly used due to its simplicity and interpretability. In this context, gross value added per employee (GVA per employee, or GVA PE) serves as an indicator of labour productivity in manufacturing. Table 2 presents GVA PE data for the sample of countries in 2020. Labour productivity in older EU member states is significantly higher than in post-transition economies. Austria leads with €88,000 per employee in manufacturing, followed by Germany and Italy with €79,000 and €68,000, respectively.

In the five-year period under review, Croatia maintained its 9th position out of the 12 observed countries, reflecting a relatively less advanced and less competitive manufacturing sector. Among other post-transition economies, Slovenia stands out with €46,000 in GVA PE, outperforming all other new EU member states. It is followed by Czechia, Hungary, Poland, and Slovakia, which recorded values ranging from €30,000 to €39,000—all countries that joined the EU in the mid-2004 enlargement wave.

Croatia recorded €23,000 in 2016 and €25,000 in 2020, placing it at approximately one-third of the average EU manufacturing GVA PE level. It is the only country within the €20,000–€29,000 range. Countries with lower GVA PE values include Bulgaria, Romania, and Serbia. When examining GVA PE growth from 2016 to 2020, Croatia ranks among the slower-growing countries, with a modest increase of €2,000. In contrast, the leading post-transition economies registered more substantial increases of €4,000 to €6,000, with the exception of Slovakia.

The level of value added generated is, among other factors, a reflection of a country's specific manufacturing technological structure. Higher R&D intensity across technology groups typically corresponds to the production of more complex and sophisticated goods. Table 2 demonstrates that higher value added is consistently generated within the higher-technology groups in all countries. GVA PE is positively associated with the level of R&D intensity, and productivity across technology groups follows a development pattern—more developed economies systematically generate higher GVA PE at all levels of technological intensity and are closer to the technological frontier.

Complete data across all technology groups are not available for every post-transition country. For Croatia, only data for high-technology (HTC) and medium-low-technology (MLTC) groups are available. Austria and Germany lead in the high-tech segment, with HTC GVA PE exceeding €110,000 and MHTC over €90,000. Austria is the closest to the technological frontier across all manufacturing technology groups; even in the low-technology segment, its GVA PE surpasses €80,000.

Among post-transition countries, Slovenia leads in all technology groups, particularly in HTC, where it reaches €88,000. Croatia's GVA PE in the HTC segment (€54,000) aligns with values observed in more advanced post-transition economies such as Czechia and Hungary. However, in the MLTC segment (€28,000), Croatia lags behind these peers.

Table 2: Average GVA per employee in 2020 across technology groups and in manufacturing industry, in thousand euro (countries ranked by GVA per employee in manufacturing in 2020)

	HTC	MHTC	MLTC	LTC	Total manufacturing industry (2020)	2020/2016 difference
Austria	117	91	86	81	88	-1
Germany	111	91	67	60	79	0
Italy	107	76	63	59	68	-3
Slovenia*	88	42	42	37	46	5
Czechia	52	38	36	34	37	4
Hungary	56	40	36	22	35	4
Poland	40	37	34	28	33	6
Slovakia	-	34	36	-	32	1
Croatia	**54**	**-**	**28**	**-**	**25**	**2**
Romania	26	23	-	-	19	5
Bulgaria	28	19	20	13	17	3
Serbia	26	15	21	15	17	2

Notes: - denotes that data are not available; * In the case of Slovenia, HTC-, HTMC-, MHTC- and LTC-data refer to 2019, while Total manufacturing industry-data refers to 2020.

Source: FINA based on Eurostat data; authors calculations of 2020/2016 difference

From an economic policy perspective, a greater share of higher value-added manufacturing groups is desirable, as these sectors are typically associated with higher levels of productivity. It is generally assumed that firms in these industries compete trough quality and innovation, in contrast to low-value segments where price competitiveness tends to dominate. The relative size of manufacturing technological groups can be assessed through the number of employees, particularly during the post-COVID-19 period, when financial and economic indicators may be less reliable due to price instability and disrupted market conditions.

For the purposes of cross-country comparison, Table 3 presents the number of employees per 100,000 inhabitants in 2020, disaggregated by manufacturing technology groups. The five countries with the highest number of employees in high-technology manufacturing (HTC) per 100,000 inhabitants—Germany, Slovenia, Hungary, Czechia, and Austria—also report higher employment in medium-high-technology manufacturing (MHTC) and in the overall manufacturing sector. This pattern may suggest that higher-technology groups contribute to the development and growth of adjacent technological segments through value chain linkages.

Within the observed sample, Croatia records the lowest number of employees per 100,000 inhabitants in the higher-technology manufacturing segment, while simultaneously ranking among the highest in lower-technology manufacturing employment.

Specifically, Croatia and Bulgaria are the only two countries in which the number of employees in low-technology manufacturing (LTC) exceeds 3,000 per 100,000 inhabitants in 2020—Bulgaria with 3,489 and Croatia with 3,208. With only 243 per 100,000 inhabitants in HTC,

Croatia is at approximately one-third the level recorded in Slovenia and Hungary. Moreover, Croatia also exhibits a very low number of employees in MHTC.

Table 3: Number of employees per 100.000 inhabitants across technology groups in 2020 (countries ranked by the number of employees per 100.000 inhabitants in HTC)

	HTC	MHTC	MLTC	LTC		Total manufacturing industry
Germany	784	3,929	2,526	2,009		9,247
Slovenia*	759	3,173	3,485	2,354		9,606
Hungary	712	2,470	2,109	2,185		7,476
Czechia	546	4,223	3,390	2,275		10,434
Austria	493	2,482	2,311	2,162		7,448
Italy	336	1,595	1,742	1,895		5,568
Romania	280	1,563	1,453	2,484		5,780
Bulgaria	273	1,805	1,771	3,489		7,339
Poland	270	1,628	2,325	2,706		6,929
Croatia	**243**	**886**	**2,260**	**3,208**		**6,597**
Serbia	175	1,698	1,438	2,522		5,832
Slovakia	n.a.	3,099	2,473	n.a.		7,782

* In the case of Slovenia, HTC-, HTMC- and LTC-data for refer to 2019, while MLTC- and Total manufacturing industry-data refer to 2020.

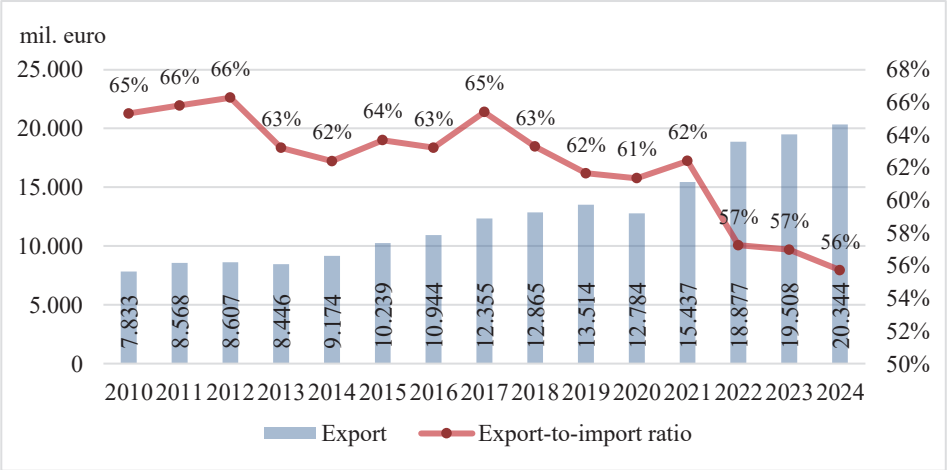
Source: Author's calculations based on FINA/Eurostat data (GVA) and Eurostat data (number of inhabitants)

To reflect post-2020 developments, FINA/Eurostat sectoral data are complemented with FINA business data for 2023. Despite some methodological differences, both datasets use comparable classifications, enabling a consistent view of employment shifts across technology groups. FINA data show that in 2023, 81% of employees in Croatian manufacturing were employed in lower-technology groups, with the remaining 19% in higher-technology sectors. Compared with the pre-COVID period, the number of employees in high-technology manufacturing (HTC) fell by 7% by 2023. A modest 1% increase was recorded in MHTC. Trends in low-technology groups were mixed: employment declined by 4% in LTC, while MLTC recorded a 5% increase.

4.2. Manufacturing Export Competitiveness

Over the past 15 years, the value of exports generated by Croatia's manufacturing sector has steadily increased. However, this growth has been outpaced by the rise in imports, resulting in a widening trade gap. This trend is reflected in the export-to-import ratio, which declined from 65% in 2010 to 61% in the COVID-19 year (2020), and further to 56% in 2024, as illustrated in the figure below. Throughout the entire period, Croatia recorded a negative trade balance. A further deterioration began in 2022, driven by inflationary pressures and disruptions in global supply chains.

Figure 1: Value of Croatian export (in mil. euro) and export-to-import ratio (in %) generated by total manufacturing (C) in 2010 – 2024



Source: CBS data (value of export) and author's calculations based on CBS data (export-to-import ratio)

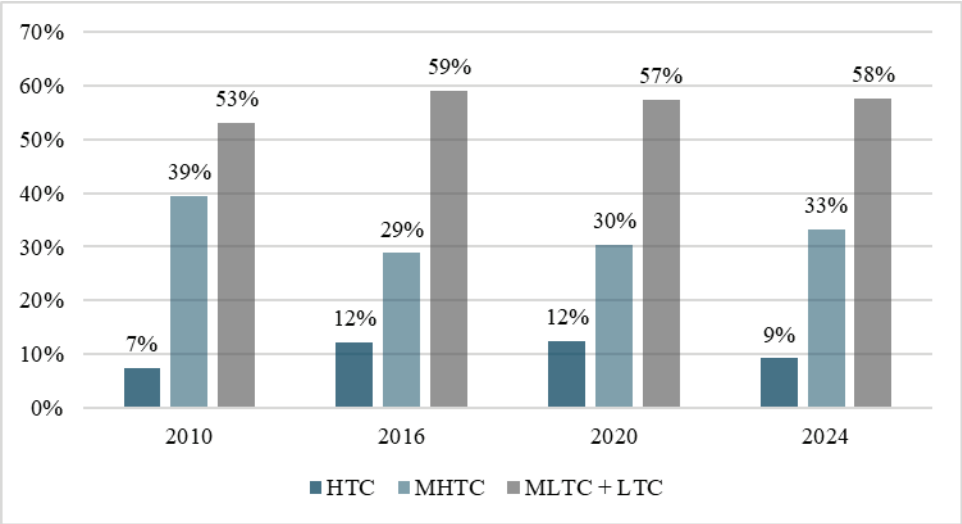
Data from the CBS on exports and imports of goods are reported according to the manufacturing branches from which the products originate, based on the production approach. A limitation of this dataset is that exports from some manufacturing branches are reported individually, while others are grouped. Nonetheless, the data allow for aggregation into technology groups according to the 2-digit NACE 2007 classification. Using these data, Croatian manufacturing exports have been grouped into three technological categories:

1. High-technology manufacturing (HTC),
2. Medium-high-technology manufacturing (MHTC),
3. Medium-low-technology and low-technology combined (MLTC and LTC), due to classification limitations.

The results of this aggregation are presented in Figure 2, illustrating changes between 2010 and 2024. The technological structure of Croatian exports has become increasingly less sophisticated during this period:

- Low-technology manufacturing exports consistently dominate the export structure, accounting for over 50% and approaching 60% by 2024.
- In contrast, the high-technology segment (including MHTC) has seen a decline in its share, falling from 46% in 2010 to 42% in 2024. The most significant reduction is observed in the MHTC category, which decreased by 6 percentage points over the 14-year period.

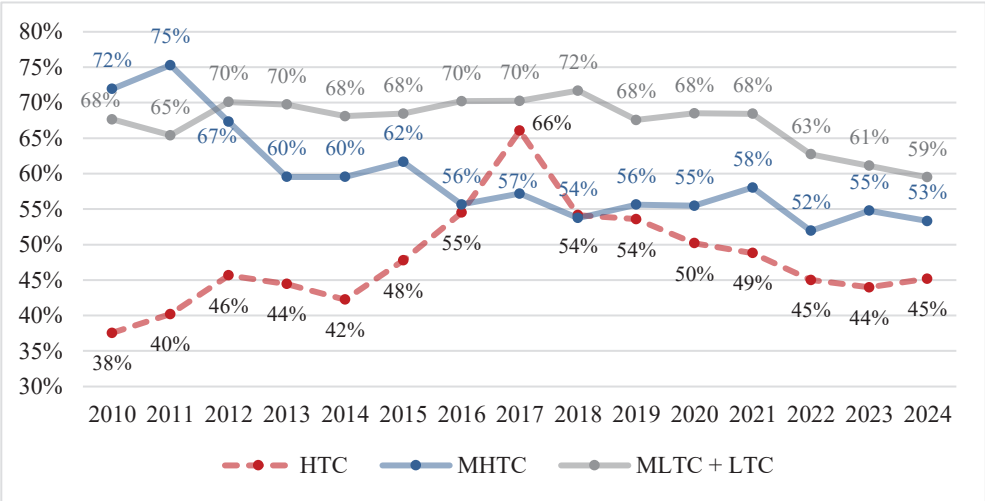
Figure 2: Structure of Croatian export across manufacturing technology groups in 2010, 2016, 2020 and 2024



Source: Author's calculations based on CBS data

The export-to-import ratio of the Republic of Croatia is a key indicator for assessing developments in economic competitiveness. Figure 3 illustrates this ratio across different manufacturing technology groups. Throughout the observed period, export values in all technological categories of manufacturing remained significantly lower than import values. However, the ratio was notably more favourable at the beginning of the period for two groups: in 2010, the export-to-import ratio stood at 72% for MHTC and 68% for the low-technology segment. A marked deterioration is visible in the post-COVID period across all technology groups.

Figure 3: Export-to-import ratio of the Republic of Croatia (in %) across technology groups in manufacturing in 2010 – 2024

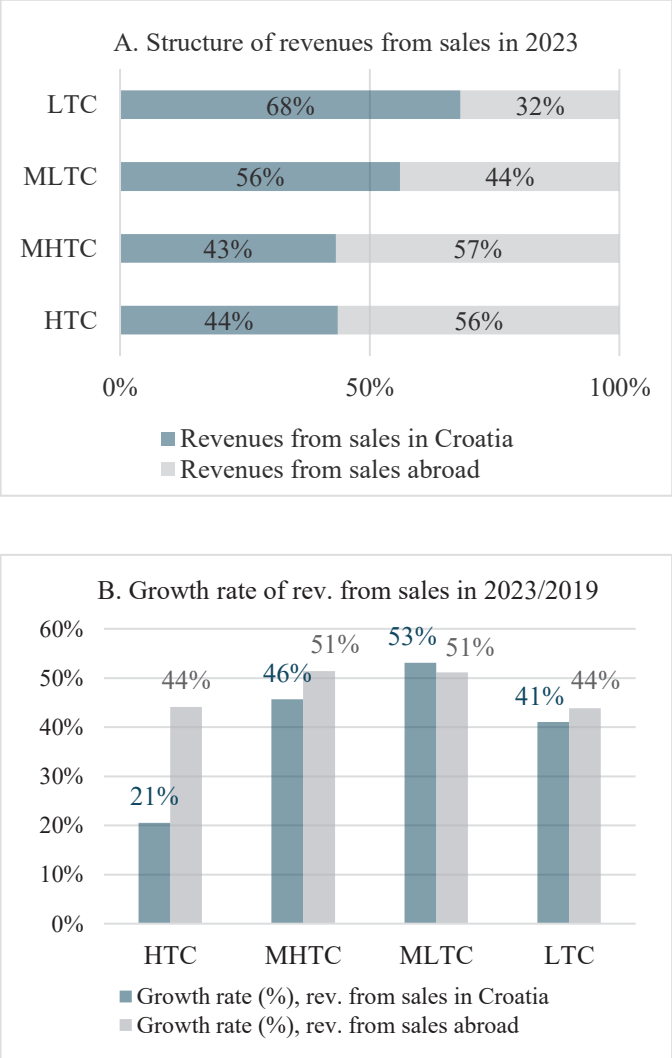


Source: Author's calculations based on CBS data

Sales revenue data for Croatian manufacturing in 2023 reveal that high-technology manufacturers are primarily export-oriented, while low-technology manufacturers remain

mostly focused on the domestic market (Figure 4). Compared to the pre-COVID year of 2019, revenues increased in all technology groups, with greater relative growth in international markets. This trend may partly reflect producers' adjustment of prices and wages in response to inflation, largely driven by rising import prices.

Figure 4: Structure of revenues across technology groups of Croatian manufacturing industry in 2023 and their growth rate in 2023/2019



Source: Author's calculation according to FINA data

FINA data show that opportunities to expand value added in high-technology content (HTC) exports appear constrained, as evidenced by the relatively modest 9% increase in total value added in 2023 compared to 2019. In contrast, other technological groups recorded more substantial value-added growth, likely influenced in part by adjustments in producer prices.

Producers operating in standardised, low-value international market segments face stronger price competition and thus have limited flexibility in price-setting. Price competitiveness is a crucial dimension of international competitiveness. The real effective exchange rate (REER) is commonly used to assess a country's cost competitiveness relative to key global competitors.

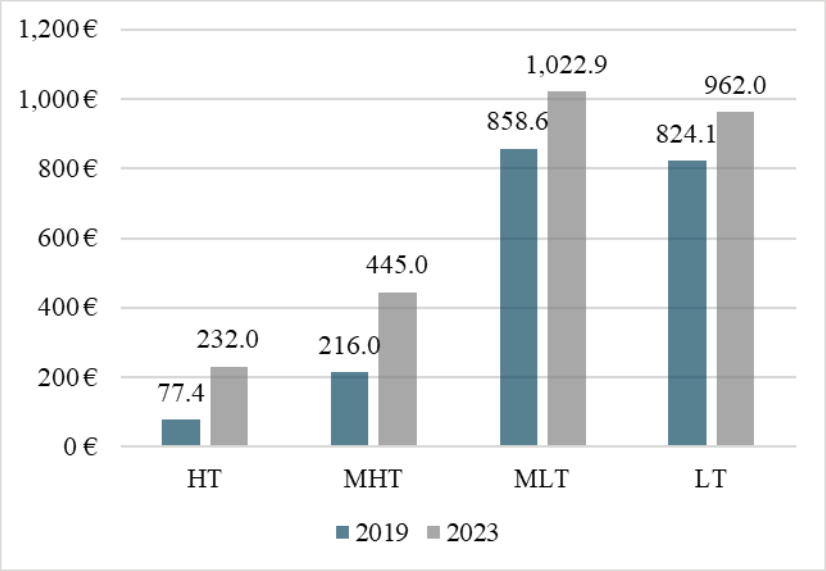
According to Eurostat (2025a) REER, Croatia's price competitiveness is worsening, with the index rising throughout 2023–2024.

During the post-COVID period, inflationary pressures were widespread across the EU but more pronounced in post-transition economies. Some governments implemented countermeasures—such as energy price subsidies, while others did not, resulting in considerable variation in inflation rates across the EU. Wage adjustments also followed, most prominently in the public sector through collective bargaining, while the private sector responded to inflation by adjusting product prices and wages.

4.3. Investments and Innovation in the Manufacturing Industry

Growth of investments into fixed capital is important for enhancing productivity in manufacturing, primarily through the capital-labour ratio. Gross fixed capital investment in Croatian manufacturing (buildings, machinery and equipment, and means of transport) increased across all technology groups in 2023 compared to 2019 (Figure 5). These investments are essential for modernising and expanding production capacities. The availability of EU funds contributed to this positive trend to some extent. Although the bulk of investments were recorded in the lower-technology segment (85% in 2019 and 75% in 2023), the relative increase in the higher-technology segment during this period was more substantial.

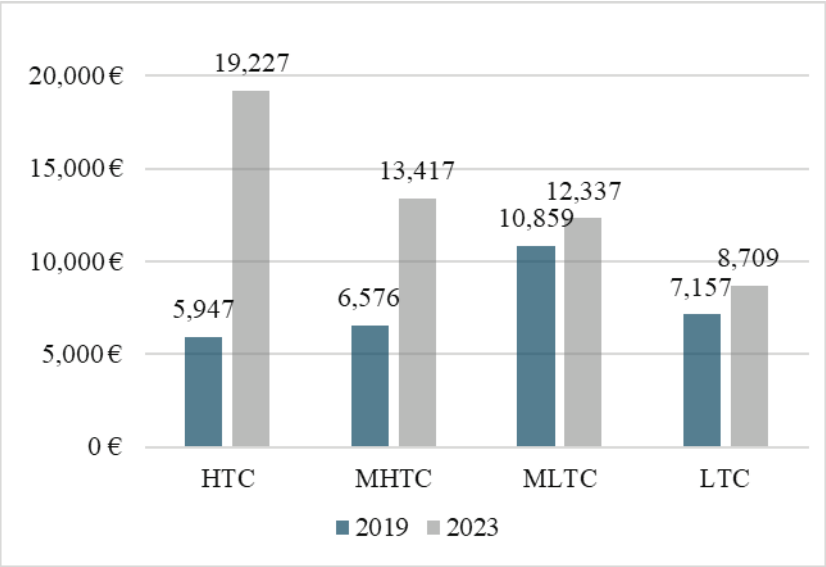
Figure 5: Gross investments into fixed capital of the Croatian manufacturing across technology groups in 2019 and 2023, in million euro



Source: Author's calculations based on FINA data

Figure 6 illustrates the capital-labour ratio across technology groups in 2019 and 2023. As expected, the ratio follows the technology-intensity hierarchy, being highest in HTC, followed by MHTC, MLTC, and LTC.

Figure 6: Capital-labour ratio in the Croatian manufacturing across technology groups in 2019 and 2023, in euro



Source: Author's calculations based on FINA data

Innovation represents another key driver of productivity growth. Positive trends related to innovation activity are visible in all manufacturing technology groups, but most prominently in the higher-technology segment. In 2019, R&D expenditure per employee was highest in MHTC at €2,215. This group also recorded the most significant increase by 2023, reaching €9,534. In HTC, values ranged between €900 and €1,500 from 2019 to 2023, showing gradual growth toward the end of the period. In contrast, R&D spending in the low-technology segment was markedly lower—€234 in MLTC in 2014 and just €68 in LTC in 2023. It is likely that EU innovation funding programmes have supported some of the R&D dynamics across all technology groups.

Table 4: R&D expenditure per employee 2019-2023, in euro

	2019	**2020**	**2021**	**2022**	**2023**
HTC	1,219	929	1,045	1,481	1,351
MHTC	2,215	3,019	1,834	6,357	9,534
MLTC	109	128	209	235	234
LTC	36	32	38	39	68

Source: Author's calculations based on FINA data

5. Conclusions

The analysis of economic and structural indicators up to 2023/2024 reveals that Croatia's manufacturing technology structure remains among the least advanced in the group of selected EU post-transition economies. The country exhibits one of the highest employment levels in low-technology manufacturing and one of the lowest in high-technology segments. Moreover, labour productivity growth has been slow, particularly up to 2020.

These findings corroborate earlier research (2000–2017/2018) that characterised Croatian manufacturers as competing primarily in the low-value segment of standardised products. An overview of FINA/Eurostat data presented in this paper shows that Czechia, Slovenia, Hungary, and Poland lead in manufacturing labour productivity in a sample of post-transition economies. More developed EU economies are consistently more productive across all technology groups, positioned near or at the global technology frontier.

International rankings as recent as 2023 further confirm the lower complexity of the Croatian manufacturing sector compared to that of incumbent EU member states. In fact, Croatia's position in these rankings has declined in recent years, while countries such as Slovenia, Czechia, and Hungary have advanced and now rank among the world's most complex economies.

The global inflationary wave following 2021 has also affected Croatia, particularly in tradable goods prices, as reflected in both exports and imports of manufacturing goods. Data through 2024 show declining export-to-import ratios across all manufacturing technology groups. Exports from lower-technology segments (LTC and MLTC) have consistently dominated Croatia's manufacturing export structure—accounting for up to 59% in 2016, 2020, and 2024—while HTC exports held only 9%, and MHTC exports 33%, in 2024.

Higher-technology industries are more export-oriented, whereas lower-technology industries focus primarily on the domestic market. Opportunities for expanding value added in HTC exports appear limited, as shown by the relatively modest growth of total value added (+9%) in 2023 compared to 2019. In contrast, other technology groups experienced stronger value-added growth, most likely partially driven by producer price adjustments. Employment in HTC and LTC declined in 2023 compared to 2019, while MHTC recorded slight growth and MLTC experienced a more pronounced increase. The manufacturing labour market in Croatia remains strained, with evident workforce shortages, prompting companies to increasingly invest in technologies aimed at improving efficiency.

Croatia's manufacturing technology structure is also shaped by strong domestic demand for lower-technology products, largely driven by tourism and construction activity. This dynamic has also contributed to a self-reinforcing, unfavourable manufacturing technological structure, accompanied by persistent productivity gaps across all technology groups when compared to leading post-transition economies and economies at the technological frontier. Although lower-technology groups are important for employment generation, high-technology sectors are generally highly potent in encouraging other higher-value added activities through value chains and knowledge spillover.

In recent years, several positive trends have emerged that support productivity growth and may facilitate some structural transformation. Notably, investments in fixed capital increased between 2019 and 2023, contributing to a higher capital–labour ratio—an important determinant of productivity. Most of the fixed capital investment in 2023 was concentrated in medium-low and low-technology manufacturing (MLTC and LTC), which together accounted for 75% of total manufacturing investment. These investments were primarily directed toward capacity expansion or technology replacement. However, when measured on a per-employee basis, the capital–labour ratio follows the expected technology-intensity hierarchy: highest in high-technology content (HTC), followed by medium-high (MHTC), medium-low (MLTC), and low-technology content (LTC) industries. Higher-technology groups also outperform in per-employee innovation indicators, including gross investment in intangible assets.

This paper also has several methodological limitations. First, there may be classification inconsistencies in the FINA annual accounts dataset, as firms may be grouped under NACE 2007 codes that do not fully reflect their revenue structure, introducing potential statistical bias. However, comparison between FINA and FINA/Eurostat employment data suggests only minor discrepancies, likely due to the use of two different NACE levels (2-digit and 3-digit) in technology group classification. Second, price effects were not directly adjusted for in value indicators, but the use of multiple trade and economic indicators helped mitigate this limitation.

Post-2021 disruptions in global supply chains have opened new opportunities for European post-transition economies, including Croatia, through nearshoring and supply chain shortening. Larger industries may seek to diversify their suppliers and relocate production within EU borders. However, inflation dynamics and cost-related challenges continue to undermine Croatia's manufacturing cost competitiveness.

This paper contributes to the understanding of the conditions that give rise to and reinforce an unfavourable manufacturing technological structure. In an era of abrupt economic shifts and increasing protectionism, there is a growing need for a more ambitious and adaptive industrial policy—one capable of addressing productivity gaps, structural weaknesses, and challenges in price competitiveness. The findings may serve as a valuable input for policymakers and industry stakeholders engaged in strategic policy design.

REFERENCES

Basarac, M., Vučković, V. (2011): ***Analiza izvozne konkurentnosti hrvatske prerađivačke industrije***, Ekonomski pregled, Vol. 62, No. 12, pp. 729-751. https://hrcak.srce.hr/77612 (accessed 19 February 2025)

Buturac, G. (2017): ***Ekonomija u uvjetima visoke zaduženosti: slučaj Hrvatske***, Ekonomski pregled, Vol. 68, No. 1, pp. 3-31. https://hrcak.srce.hr/179100 (accessed 19 February 2025)

Buturac, G. (2013): ***Nakon globalne recesije: uzajamna trgovina i ekonomska konvergencija***, Ekonomski pregled, Vol. 64, No. 4, pp. 303-326. https://hrcak.srce.hr/106541 (accessed 19 February 2025)

Buturac, G. (2009): ***Structural characteristics of exports and imports of croatian manufacturing***, Ekonomski pregled, Vol. 60, No. 9-10, pp. 432-457. https://hrcak.srce.hr/42614 (accessed 19 February 2025)

Buturac, G., Gržinić, J. (2009): ***The Competitiveness of Croatian Export to EU Markets***, Zagreb International Review of Economics & Business, Vol. 12, No. 1, pp. 39-51. https://hrcak.srce.hr/78678 (accessed 19 February 2025)

Buturac, G., Vizek, M. (2015): ***Export of Croatian food industry and effects on economy: the case of Croatia***, Ekonomski pregled, Vol. 66, No. 3, pp. 203-230. https://hrcak.srce.hr/143880 (accessed 19 February 2025)

Buturac, G. (2018): ***Perspektive razvoja industrije hrane i pića u međunarodnom okruženju: slučaj Hrvatske***, Ekonomski pregled, Vol. 69, No. 2, pp. 131-162. https://hrcak.srce.hr/199308 (accessed 19 February 2025)

Duspara, L., Knežević, S., Turuk, M. (2017): ***Competitiveness and innovation challenge in Croatia***, Poslovna izvrsnost, Vol. 11, No. 2, pp. 41-57. https://doi.org/10.22598/pi-be/2017.11.2.41 (accessed 19 February 2025)

CBS – Central Bureau of Statistics (2025): STATISTIKA U NIZU – ROBNA RAZMJENA S INOZEMSTVOM, https://podaci.dzs.hr/hr/statistika-u-nizu/ (accessed 30 March 2025)

Eurostat. Annex 3 – High-tech aggregation by NACE Rev.2, https://ec.europa.eu/eurostat/cache/metadata/en/htec_esms.htm (accessed 25 February 2025)

Eurostat (2025): Gross domestic product at market prices, DOI: 10.2908/tec00001 (accessed 25 February 2025)

Eurostat (2025a): Real effective exchange rate - index, 42 trading partners, DOI: 10.2908/tipser13 (accessed 4 April 2025)

Eurostat (2024): Population on 1 January, https://doi.org/10.2908/TPS00001 (accessed 20 November 2024)

FINA, InfoBIZ database, https://infobiz.fina.hr/landing (accessed 20 December 2024)

Harvard Growth Lab (2025): ***Country & Product Complexity Rankings,*** Atlas 11.0.1, https://atlas.hks.harvard.edu/rankings (accessed 25 February 2025)

European Commission: Joint Research Centre, PUGLIESE, E. and TACCHELLA, A., 2021, ***Economic Complexity Analytics: Country factsheets - Croatia***, DOI: 10.2760/368138 (online) (20 December 2024)

Jurčić, Lj. (2017): ***Svjetsko gospodarstvo deset godina nakon početka krize***, Ekonomski pregled, Vol. 68, No. 6, pp. 655-685. https://hrcak.srce.hr/191145 (accessed 19 February 2025)

Nikolić, H., Miloloža, I. (2018): ***Pregled istraživanja o izvoznim aktivnostima Republike Hrvatske u razdoblju od 2007. do 2017.***, Poslovna izvrsnost, Vol. 12, No. 1, pp. 161-180. https://doi.org/10.22598/pi-be/2018.12.1.161 (accessed 19 February 2025)

The Observatory of Economic Complexity (OEC) – ***Complexity rankings Countries (ECI) Rankings***, https://oec.world/en/rankings/eci/hs6/hs96?tab=ranking (accessed 10 March 2025)

The Observatory of Economic Complexity (OEC) - ***Country profiles Croatia***, https://oec.world/en/profile/country/hrv (accessed 10 March 2025)

Stojčić, N. (2012): ***The competitiveness of exporters from Croatian manufacturing industry***, Ekonomski pregled, Vol. 63, No. 7-8, pp. 424-445. https://hrcak.srce.hr/86494 (accessed 19 February 2025)

Stojčić, N., Bačić, K., Aralica, Z. (2015): ***Proizvodnost i međunarodna konkurentnost malih i srednje velikih poduzeća u hrvatskoj prerađivačkoj industriji***, in: Croatian Economic Association conference: Ekonomska politika Hrvatske u 2016., Zagreb: Hrvatsko društvo ekonomista, 2015. pp. 92-112. https://hrcak.srce.hr/clanak/360825 (accessed 19 February 2025)

Stojčić, N., Bečić, M., Vojinić, P. (2012): ***The Competitiveness of Exports from Manufacturing Industries in Croatia and Slovenia to the EU-15 Market: A Dynamic Panel Analysis***, Croatian Economic Survey, No. 14, pp. 69-105. https://hrcak.srce.hr/80034 (accessed 19 February 2025)

Tica, J., Stojčić, N., Matić, M. (2023). ***Integracija Hrvatske u međunarodnu trgovinu prema porijeklu dodane vrijednosti***, EFZG working paper series, No. 01, pp. 1-31. https://hrcak.srce.hr/293375 (accessed 19 February 2025)

World Bank (2024): ***World Development Report 2024 - THE MIDDLE-INCOME TRAP***, https://www.worldbank.org/en/publication/wdr2024 (accessed 20 December 2024)

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ASSESSING THE EFFICIENCY OF R&D TRANSFER: A COMPARATIVE ANALYSIS OF CROATIA AND SLOVENIA

ABSTRACT

The transfer of research and development (R&D) plays a vital role in bridging the gap between science and entrepreneurship, fostering innovation, enhancing competitiveness, and driving long-term economic growth. This paper examines expert perceptions of R&D transfer efficiency in Croatia and Slovenia, based on National Expert Survey (NES) data from the Global Entrepreneurship Monitor (GEM) collected annually between 2020 and 2024. The analysis focuses on six key dimensions, including knowledge transfer from public research, access to technology, government support, and the commercialization of scientific ideas. The study aims to determine whether significant differences exist between these two countries and how these perceptions have evolved over time. Comparative statistical analyses were conducted using the Mann-Whitney U test and General Linear Models (ANOVA), with country, year, and their interaction entered as independent factors. The findings reveal that Slovenia consistently receives significantly higher ratings across five of the six dimensions, particularly in areas related to knowledge transfer, high-tech venture support, and commercialization. Differences remained statistically significant and stable throughout the five-year period, suggesting that the observed gap is structurally embedded in national innovation systems rather than driven by short-term fluctuations. Perceptions of government subsidies were the only area where no significant difference between the countries was detected. The study concludes that institutional frameworks and ecosystem maturity are crucial in shaping how R&D transfer is perceived and potentially implemented.

Key words: *R&D transfer, Entrepreneurship, Global Entrepreneurship Monitor, Croatia, Slovenia.*

1. Introduction

Based on the work of numerous authors, it can be concluded that universities play an increasingly important role in promoting innovation through knowledge transfer, particularly in modern knowledge-based economies (e.g., Etzkowitz, 2003; Tijssen, 2006; Bekker & Freitas, 2008). This paper examines the theoretical foundations of knowledge transfer, its importance for economic development and the institutional context in which such transfer occurs—particularly within national innovation systems Special attention is given to challenges such as “stickiness” and ambiguity in the interpretation of knowledge, and to conceptual models

like the Triple Helix. The study uses data from the GEM database to analyze expert perceptions of R&D transfer efficiency in Croatia and Slovenia, offering insights into system-level differences and laying the groundwork for future empirical research on the institutional drivers of innovation

2. Literature review

The role of universities in promoting innovation through knowledge transfer is increasingly emphasized in the context of knowledge-based economies. Numerous authors highlight that universities today are not only centers of education and research, but also active agents in economic development, innovation, and entrepreneurship through their so-called "third mission" (Etzkowitz, 2003; Tijssen, 2006; Groenewegen & Van der Steen, 2006). Furthermore, an increasing number of researchers and policy makers recognize knowledge transfer as a key mechanism for fostering innovation, competitiveness, and economic development (Thomas & Paul, 2019; Bekker & Freitas, 2008; Davenport & Prusak, 1999). Thomas and Paul (2019) point out that universities have intensified collaboration with industry, while companies are increasingly recognizing the value of scientific partnerships. In this context, knowledge transfer becomes a key process that enables the translation of scientific discoveries into practical applications.

2.1. Knowledge transfer in national innovation systems

The importance of innovation and knowledge transfer for economic growth was already recognized in the middle of the last century. As early as 1956, Solow (1956) spoke of the fact that there is a long-term relationship between economic growth and innovation. From this we can conclude that this issue is equally important for industrialized countries and developing countries. The authors Argote and Ingram (2000) say that knowledge transfer is defined as the process of acquiring knowledge in one situation and applying it in another. Bekker and Freitas (2008) add that new knowledge is created when knowledge is disseminated through the interaction between university and industry. Davenport and Prusak (1999), as in the work of Sheng et al. (2013, 462), point out that knowledge transfer involves two actions: "transmission (sending or presenting knowledge to a potential recipient) and absorption by a person or a group. Thus, if knowledge has not been transmitted or absorbed, it has not been transferred." Renzl (2008), van Wijk et al. (2008) and Sheng et al. (2013, 462) point out that other authors also use terms such as “knowledge flow”, “knowledge sharing” and “knowledge acquisition” to describe knowledge transfer when discussing this area.

It is important to point out that innovative thinking behaviour plays an extremely important role, which occurs when there is access to different knowledge and experience, and is discussed by Akhavan et al. (2015). According Tijssen, universities as key actors in the knowledge and innovation system “have the stock of knowledge and expertise, the knowledge-generating capabilities, and the research facilities to engage in science-based entrepreneurial activities” (Tijssen, 2006, 1570). Etzkowitz (2003) points out that the role of universities today is no longer limited to education and research. In today's context, the so-called “third mission” of universities is increasingly coming to the fore, which implies their active role in economic and social development. Etzkowitz (1996) emphasises that it is precisely this third dimension that is linked to the concept of the entrepreneurial university – an institution that not only teaches and conducts research, but also makes a concrete contribution to society by transferring knowledge, promoting innovation and collaborating with industry and the public sector. With

such an approach, the university becomes a dynamic player in society – not just an observer, but also an initiator of change. This means that universities are increasingly taking on the responsibility of encouraging the creation of new businesses and industries, making them important partners in the development of the economy and society as a whole. “The Triple Helix model” of innovation proposed by Etzkowitz (1996) focuses on the relationship between universities, government and industry. The model is based on the idea that interaction and collaboration between these sectors promote innovation and economic development. Universities contribute through research and the development of new knowledge, industry uses this knowledge to create products and services, and governments provide the necessary regulations and support to encourage innovation. Etzkowitz explains why the university plays a crucial role in this context: "The university is also a potential seedbed for new interdisciplinary scientific fields and new industrial sectors, each cross-fertilizing the other" (Etzkowitz, 2003, 112).

According to Tijssen (2006), university organizations are able to create new resources or use existing resources and facilities in such a way that the results of intramural research and development activities are used and commercialized as assets that can be traded on the open market in a competitive business environment by a new or existing company. Groenewegen and Van der Steen (2006) point out that governments around the world are increasingly adopting the National Innovation Systems (NIS) approach to promote innovation, which provides a holistic view of innovation dynamics. Tijssen noted that "all high-ranking countries are advanced industrialized nations that have developed knowledge-based economies with R&D-intensive industries and large science-dependent enterprises" (Tijssen, 2006, 1575). While Pece et al. (2015) talk about how empirical research confirms how specific economic mechanisms (tax breaks and subsidies) influence innovation. Recent OECD (OECD, 2024, 2025) highlight the evolving role of venture capital in supporting innovation-driven entrepreneurship, particularly in economies with well-developed innovation systems and supportive legal frameworks. It is important to emphasize that "The innovation process can be conceptualized as progressing along a continuum of stages, from early stage R&D, through demonstration, to revision and supported commercial deployment, all the way through to mature market technologies being produced and used at scale. There are limits to what earlystage R&D efforts in developing countries can achieve, as they may primarily be relevant to countries with higher existing levels of technological capacities" (Bell 2009) and less so to lower-income countries" (Ockwell et al., 2015, 402).

In recent years, several studies have significantly advanced the understanding of university–industry knowledge transfer (UIKT), particularly within systemic and institutional contexts. Ballesteros-Ballesteros and Zárate-Torres (2025) provide a conceptual overview of four decades of UIKT research, identifying key themes such as innovation, higher education, technology transfer, knowledge governance, and academic entrepreneurship. Their analysis highlights the central role of universities in innovation ecosystems. Argote (2024) offers a theoretical synthesis of knowledge transfer mechanisms, stressing the importance of motivation, trust, and context alongside formal structures. Perkmann et al. (2021) add nuance by distinguishing between relational engagement (e.g., joint research) and transactional commercialization (e.g., licensing, spin-offs), showing that effective knowledge transfer depends on organizational culture and supportive policy environments. Together, these recent contributions shift the focus from linear models toward more dynamic, multi-actor, and context-sensitive processes.

2.2. Key concepts and barriers in knowledge transfer

Understanding the mechanisms, challenges, and theoretical underpinnings of knowledge transfer is essential for analyzing how innovation occurs across institutional boundaries. While the term "knowledge transfer" is widely used, it encompasses a range of related processes and is interpreted differently across disciplines. According to Sheng et al. (2013), there are two main barriers to knowledge transfer, namely: "stickiness" and ambiguity of knowledge. "Stickiness" means that knowledge is difficult to transfer – either because someone does not want to share it or because it is complicated to transfer. This is one of the main reasons why knowledge transfer often fails. If knowledge – is not clearly defined or difficult to understand, it is even less likely that someone will successfully transfer it to others. Both obstacles – stickiness and ambiguity – combine to severely limit the effective flow of knowledge from one person or organization to another. Cummings and Teng (2003) point out that many companies have difficulty transferring knowledge effectively, even though it is critical to the development of new products. For this reason, in a review of the existing literature, the authors concluded that the success of knowledge transfer can be defined differently depending on the theoretical approach.

Although the main goal of any knowledge transfer is to effectively reach the recipient, there are several ways to measure this "success". The first and simplest way is quantitative – the number of knowledge transfers in a given period of time. The second is based on project management and focuses on whether the transfer is according to plan (time, cost) and the user is satisfied. The third approach emphasizes the extent to which the recipient can actually comprehend and apply the knowledge – for example, through new products, processes or organizational changes. Here, knowledge transfer is not seen as a simple copy, but as a complex learning and adaptation process that involves many interlinked elements (people, tools, routines, networks). However, it is precisely because of this complexity that it is difficult to determine exactly whether the transfer was really successful. The fourth approach, on which the author of the paper relies, looks at the success of the transfer from the perspective of institutional theory. In this context, the transfer is successful if the recipient experiences the knowledge as their own – if they show commitment, a sense of ownership and satisfaction with the transferred knowledge. This sense of ownership can grow if the recipient has the freedom to adapt the knowledge, if they come into frequent contact with it, and if they invest time and effort to understand and apply it. The emergence of new funding instruments such as the VESNA[1] venture fund, shows how the innovative potential of the scientific community can be directed towards solving real global challenges. Such funds enable scientists to obtain the necessary funding and support the translation of their ideas into marketable products.

The theoretical considerations outlined above serve as a conceptual basis for the empirical analysis that follows, focusing on Croatia and Slovenia as two comparable innovation systems in the region. Drawing on prior studies and conceptual models of knowledge transfer, we formulate the following hypothesis:

H1: Expert perceptions of R&D transfer efficiency are significantly more favorable in Slovenia than in Croatia across key dimensions of the innovation ecosystem.

Building on this conceptual foundation, the following sections outline the methodology approach and key findings, with the aim of providing a deeper understanding of how

[1] Official page of VESNA, available at: https://vesnavc.com/ (accessed 7. April 2025)

institutional, cultural, and systemic factors influence knowledge exchange in these two national contexts.

3. Methodology

This study employs a comparative quantitative research design based on survey data. Given the ordinal nature of expert evaluations and the cross-national focus, we used non-parametric and parametric statistical methods to assess perceived differences between Croatia and Slovenia over time.The analysis is based on secondary data from the Global Entrepreneurship Monitor (GEM) National Expert Survey, covering the years 2020 to 2024. The data includes evaluations from national experts in both countries who assessed six key indicators (E01–E06) related to the transfer of research, technology, and knowledge from academia to entrepreneurial ecosystems.

The indicators include:

- E01: Efficiency of knowledge transfer from universities and public research centers
- E02: Equal access to research and technology for new firms
- E03: Affordability of the latest technology
- E04: Availability of government subsidies for new technology
- E05: Support for world-class technology-based ventures
- E06: Support for commercialization of scientific ideas

The expert responses were rated on a 0 to 10 scale, where higher values indicate stronger agreement with each statement.

The total sample consists of 365 valid expert responses across years, with 181 experts from Slovenia (49.6%) and 184 experts from Croatia (50.4%). This balanced distribution between the two countries ensures the robustness of the comparative analysis. Each country contributed approximately the same number of expert evaluations in each year. For Slovenia, the annual distribution ranged from 36 to 37 responses per year, while Croatia contributed between 36 and 38 responses annually. This even distribution ensures the comparability of the data across both time and countries. The number of valid cases slightly varies across indicators due to occasional missing values, which were treated as system-missing and excluded pairwise. A detailed breakdown is shown in Table 1.

Table 1*:* Distribution of expert responses by country and year across all six indicators (E01–E06)

		Country						**Total**		
		Croatia			**Slovenia**					
		Count	**% within Country**	**% within Year**	**Count**	**% within Country**	**% within Year**	**Count**	**% within Country**	**% within Year**
Year	2020	38	20.7%%	51.4%	36	19.9%	48.6%	74	20.3%	100.0%
	2021	37	20.1%	50.7%	36	19.9%	49.3%	73	20.0%	100.0%

		Country						Total		
		Croatia			Slovenia					
		Count	**% within Country**	**% within Year**	**Count**	**% within Country**	**% within Year**	**Count**	**% within Country**	**% within Year**
	2022	37	20.1%	50.7%	36	19.9%	49.3%	73	20.0%	100.0%
	2023	36	19.6%	50.0%	36	19.9%	50.0%	72	19.7%	100.0%
	2024	36	19.6%	49.3%	37	20.4%	50.7%	73	20.0%	100.0%
Total		184	100.0%	50.4%	181	100.0%	49.6%	365	100.0%	100.0%

Source: GEM NES (2020–2024) for Croatia and Slovenia, authors' calculations

The data analysis includes descriptive statistics to summarize average ratings for each indicator by country; Mann-Whitney U tests to assess statistically significant differences between Croatia and Slovenia for each indicator (non-parametric alternative to the t-test, due to non-normal distributions). General Linear Model (Univariate ANOVA) to examine the effects of Country, Year, and their interaction (Country × Year) on expert ratings. This allowed us to determine not only whether differences between countries exist, but also whether these differences changed over time. All analyses were performed using IBM SPSS Statistics.

4. Research results

4.1. Descriptive comparison of R&D transfer indicators

Descriptive analysis shows that Slovenia consistently receives higher average ratings than Croatia across all six indicators of R&D transfer efficiency. The largest difference is observed in E05, which refers to support for world-class technology-based ventures, where the mean score is 4.47 for Slovenia and 3.32 for Croatia. Similarly, in E01, related to knowledge transfer from universities and public research centers to new firms, Slovenia scores 3.98 compared to 3.13 in Croatia. In contrast, the smallest difference is observed in E04 (government subsidies), where the two countries are almost identical (3.66 for Slovenia and 3.63 for Croatia), suggesting similar levels of perceived public support.

Table 2*:* Mean expert ratings for R&D transfer indicators (E01–E06) in Croatia and Slovenia

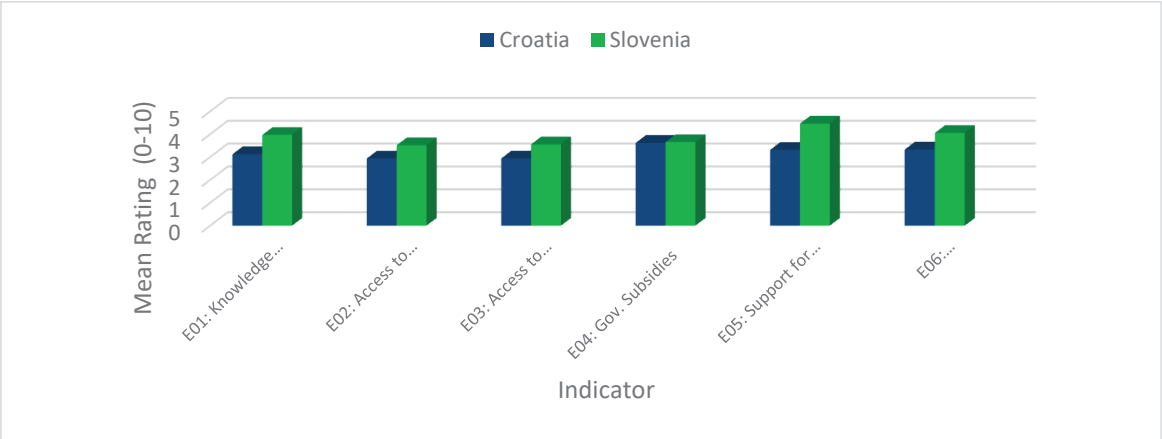
	Croatia			Slovenia			Total		
	Mean	**N**	**Std. Deviation**	**Mean**	**N**	**Std. Deviation**	**Mean**	**N**	**Std. Deviation**
In my country, new technology, science, and other knowledge are efficiently transferred from universities and public research centers to new and growing firms	3.1348	178	1.73493	3.9779	181	2.02747	3.5599	359	1.93213

In my country, new and growing firms have just as much access to new research and technology as large, established firms	2.9492	177	1.84721	3.5227	176	2.21928	3.2351	353	2.05844
In my country, new and growing firms can afford the latest technology	2.9497	179	1.88809	3.5618	178	2.12574	3.2549	357	2.03053
In my country, there are adequate government subsidies for new and growing firms to acquire new technology	3.6286	175	1.94885	3.6629	175	2.10515	3.6457	350	2.02567
In my country, the science and technology base efficiently supports the creation of world-class new technology-based ventures in at least one area	3.3216	171	1.97530	4.4667	165	2.17954	3.8839	336	2.15273
In my country, there is good support available for engineers and scientists to have their ideas commercialized through new and growing firms	3.3353	173	1.79883	4.0632	174	2.10738	3.7003	347	1.99046

Source: GEM NES (2020–2024) for Croatia and Slovenia, authors' calculations

Figure 1 presents the mean expert ratings for six indicators of R&D transfer efficiency (E01–E06) for Croatia and Slovenia over the period 2020–2024. Across all indicators, Slovenia received higher average scores than Croatia, indicating more favorable expert perceptions of the country's R&D transfer environment.

Figure 1: Perceived efficiency of R&D transfer – Croatia vs. Slovenia



Note: Ratings were provided by national experts on a scale from 0 (completely false) to 10 (completely true). Higher values indicate stronger agreement with each statement.

Source: GEM NES (2020–2024) for Croatia and Slovenia, authors' calculations

The most pronounced differences are observed in E05 (support for the creation of world-class new technology-based ventures), where Slovenia scored 4.47 compared to Croatia's 3.32, and in E01 (efficient transfer of knowledge from universities and public research centers), where Slovenia averaged 3.98 while Croatia averaged 3.13. These differences suggest a stronger perceived institutional infrastructure and innovation ecosystem in Slovenia. On the other hand, the smallest difference is noted in E04 (government subsidies for new and growing firms to acquire technology), where both countries received nearly identical ratings—3.66 in Slovenia and 3.63 in Croatia—implying a similar perception of public financial support mechanisms. The standard deviations are relatively high for all items, reflecting some variability in expert responses, which is expected in perception-based data collected across multiple years and expert profiles.

4.2. Statistical significance testing (Mann-Whitney U)

To determine whether these differences are statistically significant, Mann-Whitney U tests were conducted for each indicator (Table 3).

Table 3*:* Results of Mann-Whitney U tests for differences in expert ratings between Croatia and Slovenia (E01–E06)

	Mann-Whitney U	**Wilcoxon W**	**Z**	**Asymp. Sig. (2-tailed)**
In my country, new technology, science, and other knowledge are efficiently transferred from universities and public research centers to new and growing firms	12308.000	28239.000	-3.915	<.001
In my country, new and growing firms have just as much access to new research and technology as large, established firms	13320.500	29073.500	-2.383	.017
In my country, new and growing firms can afford the latest technology	13169.000	29279.000	-2.869	.004
In my country, there are adequate government subsidies for new and growing firms to acquire new technology	15130.000	30530.000	-.195	.845
In my country, the science and technology base efficiently supports the creation of world-class new technology-based ventures in at least one area	9744.000	24450.000	-4.952	<.001
In my country, there is good support available for engineers and scientists to have their ideas commercialized through new and growing firms	11878.500	26929.500	-3.433	<.001

Source: GEM NES (2020–2024) for Croatia and Slovenia, authors' calculations

Table 3 displays the results of Mann-Whitney U tests conducted to assess whether expert ratings of R&D transfer indicators differ significantly between Croatia and Slovenia. The results show that five out of six indicators exhibit statistically significant differences between the two countries ($p < 0.05$). The most significant differences were found in E01 (knowledge transfer from universities and public research centers), $Z = –3.915$, $p < 0.001$; E05 (support for high-tech ventures), $Z = –4.952$, $p < 0.001$; and E06 (commercialization support), $Z = –3.433$, $p < 0.001$. These results reinforce the descriptive findings, indicating that Slovenia is consistently

perceived as having a more effective system for transferring research and technology to entrepreneurial practice.

The only indicator where no statistically significant difference was found is E04 (government subsidies for acquiring technology), Z = –0.195, p = 0.845. This confirms that both countries are seen as similarly positioned in terms of government financial support for R&D adoption.

4.3. Effects of country and year (General Linear Model Analysis)

The General Linear Model (Univariate ANOVA) was conducted to examine the effects of Country, Year, and their interaction on expert assessments of R&D transfer efficiency across six key indicators (E01–E06). Although the expert ratings were collected on a Likert-type scale, which is technically ordinal, the General Linear Model (ANOVA) was applied in addition to non-parametric tests for two main reasons. First, when Likert-scale data approximate a normal distribution and include a sufficiently large sample, ANOVA can be a robust method for detecting differences across groups. Second, ANOVA allows for the inclusion of multiple independent variables (e.g., Country, Year, and their interaction), enabling a more comprehensive analysis of main and interaction effects over time. Nonetheless, the ordinal nature of the data introduces limitations, and results from ANOVA should be interpreted with caution and corroborated by the more conservative Mann-Whitney U test results.

A statistically significant main effect of Country was observed for all indicators except E04, indicating that Slovenian experts consistently rated their national innovation environment more favorably than Croatian experts. As showed in table xx the strongest differences appeared in E05 (support for world-class technology-based ventures, F = 25.433, p < 0.001) and E06 (support for commercialization of scientific ideas, F = 11.707, p < 0.001), followed by E01 (knowledge transfer, F = 18.086, p < 0.001), E03 (affordability of technology, F = 8.116, p = 0.005), and E02 (equality in access to research, F = 6.643, p = 0.010).

Table 4: Results of General Linear Model (ANOVA) for indicators E01–E06 (Country, Year, and Interaction Effects)

Indicator	F (Country)	p (Country)	F (Year)	p (Year)	F (Country × Year)	p (Interaction)	R^2
E01 – Knowledge transfer	18.086	< 0.001	2.670	0.032	0.615	0.652	0.082
E02 – Access to research	6.643	0.010	2.243	0.064	1.847	0.119	0.063
E03 – Technology affordability	8.116	0.005	1.461	0.214	0.333	0.856	0.042
E04 – Government subsidies	0.016	0.899	0.852	0.493	1.783	0.132	0.031
E05 – Support for high-tech ventures	25.433	< 0.001	0.213	0.931	1.023	0.395	0.085
E06 – Commercialization support	11.707	< 0.001	0.875	0.479	1.263	0.284	0.057

The Table 4 presents F-values and significance levels (p) for the effects of Country, Year, and their interaction, as well as R^2 values indicating explained variance. Bolded p-values (where applicable) indicate statistical significance at the p < 0.05 level.

Source: GEM NES (2020–2024) for Croatia and Slovenia, authors' calculations

In contrast, E04 (government subsidies) showed no significant differences between countries ($F = 0.016$, $p = 0.899$), suggesting that both expert groups perceive public financial support for technology acquisition similarly. This was also the indicator with the lowest model fit ($R^2 = 0.031$), consistent with the lack of group differences.

Across indicators, the main effect of Year was not statistically significant, with the exception of E01 ($F = 2.670$, $p = 0.032$), where expert ratings varied slightly over time. All other year effects remained non-significant (e.g., E03: $F = 1.461$, $p = 0.214$; E06: $F = 0.875$, $p = 0.479$), indicating temporal stability in perceptions.

Likewise, no statistically significant Country × Year interaction effects were observed for any of the indicators (e.g., E01: $F = 0.615$, $p = 0.652$; E06: $F = 1.263$, $p = 0.284$), suggesting that differences between Slovenia and Croatia remained consistent throughout the 2020–2024 period.

Overall, the models explained a modest but meaningful share of variance, with R^2 ranging from 0.031 (E04) to 0.085 (E05). These results underscore the persistent influence of national context—particularly institutional and systemic differences—on expert perceptions of the effectiveness of R&D transfer to entrepreneurship.

5. Discussion

The findings of this study provide consistent evidence of cross-country differences in expert perceptions of R&D transfer efficiency between Croatia and Slovenia. Across nearly all indicators, Slovenian experts rated their national systems more favorably, particularly in terms of knowledge transfer (E01), access to research and technology (E02), affordability of advanced technologies (E03), support for world-class technology ventures (E05), and commercialization of scientific ideas (E06). These differences were statistically significant in both non-parametric and parametric tests, and remained stable across a five-year period (2020–2024).

The absence of significant differences in E04—expert perceptions of government subsidies for acquiring new technology—warrants particular attention. From the authors' perspective, this result may reflect a degree of policy convergence between Slovenia and Croatia in terms of public funding instruments aimed at supporting early-stage innovation. Both countries operate within the broader EU innovation policy framework, which may lead to similar subsidy structures, especially for SMEs and research-driven firms. Alternatively, the finding could suggest that experts in both contexts view government support mechanisms as relatively underdeveloped or ineffective, leading to equally moderate assessments. In either case, this result underscores the importance of not only funding availability, but also the perceived transparency, accessibility, and impact of such instruments.

Importantly, the General Linear Model analysis confirmed that country context was the most consistent predictor of expert ratings, with year effects being largely non-significant and no interaction effects observed. This indicates that the observed differences are structural rather than temporal, rooted in systemic characteristics of each country's innovation ecosystem. Slovenia's higher scores may reflect stronger linkages between science and business, more developed support infrastructure, or a more mature entrepreneurial culture embedded within national innovation policies and practices. These findings provide support for the proposed hypothesis, confirming that expert perceptions of R&D transfer efficiency are significantly

more favorable in Slovenia than in Croatia across most evaluated dimensions. The only exception is government subsidies (E04), where no significant difference was detected, indicating partial support for the hypothesis.

Although this study does not directly assess the quality of R&D infrastructure or the degree of economic knowledge intensity, the consistently higher expert ratings in Slovenia—particularly regarding knowledge transfer (E01), support for high-tech ventures (E05), and commercialization of scientific ideas (E06)—may reflect the presence of more mature innovation-supporting institutions. This interpretation aligns with Tijssen's (2006) theoretical proposition that countries with stronger R&D systems and more knowledge-based economies tend to be more effective in translating research into economic value.

Similarly, while this research does not include direct institutional metrics on university performance, the higher Slovenian scores in areas linked to commercialization suggest that universities may play a more active or better-supported role in Slovenia's innovation ecosystem. This resonates with the "entrepreneurial university" model proposed by Etzkowitz (2003), which envisions universities as not only centers of education and research but also as proactive agents in regional economic development. Recent studies (e.g., Baba, 2024; Link & Sarala, 2019; Rinkinen et al., 2023) further emphasize the importance of university-based technology transfer offices and collaborative platforms in supporting innovation ecosystems. From a policy perspective, these findings highlight the importance of investing in institutional capacity, strengthening collaborations between academia and industry, and creating supportive environments for the commercialization of research. This supports Bekkers and Freitas's (2008) argument that new knowledge emerges through active university–industry interaction.

It also aligns with Davenport and Prusak's (1999) emphasis on the importance of both transmission and absorption for successful knowledge transfer. More recent research confirms that strategic alignment between universities and industry partners—particularly at the team level—is a key determinant of effective knowledge exchange, with trust, cognitive expertise, and operational fit identified as central enablers of successful collaboration (Almaida et al., 2023). Comparative analyses across EU Member States further confirm that countries with stronger university-business collaboration—measured through public-private co-publications and firm engagement—tend to perform better in innovation metrics, with particularly high effectiveness observed in Northern Europe (Pleśniarska, 2018). These findings reinforce the need for targeted policy instruments that promote institutionalized collaboration mechanisms, especially for SMEs.

Building on these insights, countries with less mature innovation systems can draw on these lessons to strengthen their own ecosystems. For Croatia, this could imply a need to reinforce ecosystem-building efforts, enhance the visibility and effectiveness of research transfer policies, and further develop support structures that translate scientific potential into entrepreneurial impact. While some progress has been made, research indicates that Croatian policies supporting technology parks and incubators have generated limited spin-off activity, largely due to persistent market failures in knowledge transfer and underdeveloped collaboration networks between academia and industry (Bartlett and Čučković, 2006).

6. Conclusions

This study highlights important national differences in how experts perceive the effectiveness of R&D transfer systems in Croatia and Slovenia. While the analysis confirms that these perceptions are relatively stable over time, it also reveals that systemic and institutional factors—rather than short-term changes—play a key role in shaping the innovation landscape. Beyond identifying statistical differences, the findings carry several practical implications for policymakers and innovation system stakeholders. They suggest that improving the perception and performance of R&D transfer is not merely a question of funding or isolated programs but requires strategic and structural adjustments.

Based on the findings, several policy directions emerge as particularly relevant for strengthening R&D transfer systems The following recommendations are proposed: First, it is essential to strengthen science–industry collaboration through targeted programs that foster long-term partnerships between research institutions and businesses. In parallel, commercialization infrastructure—such as incubators, accelerators, and technology transfer offices—should be further developed and professionalized to better support the transformation of research into market-ready innovations. Investing in innovation culture and mindset is equally important, especially through the integration of entrepreneurial thinking into science and engineering education at all levels. Moreover, increasing the visibility and accessibility of existing support mechanisms can ensure that entrepreneurs are both aware of and able to access the tools available to them. Finally, R&D policy impact should be monitored and evaluated regularly through expert-based assessments, which can provide valuable feedback and guide ongoing improvements in the innovation ecosystem. While these findings provide valuable insights, several limitations should be acknowledged. First, the data are based on expert perceptions, which may be influenced by contextual or cultural biases and may not fully reflect actual policy performance or innovation outcomes. Second, the relatively high standard deviations across indicators suggest a notable degree of variation in responses, which should be taken into account when interpreting national averages. Third, the study includes only two countries, which limits the generalizability of the findings to broader regional or global contexts. Fourth, although the dataset spans five years, the design is cross-sectional within each year, limiting the ability to draw causal inferences or capture dynamic changes over time. Finally, while ANOVA was applied to examine the effects of country and year, the ordinal nature of Likert-scale data calls for cautious interpretation of these results. To address this concern and enhance robustness, findings were triangulated with non-parametric Mann-Whitney U tests, which confirmed the same key differences between countries. Future research could address these limitations by expanding the scope to include more countries and adopting panel or longitudinal methods to better capture changes over time. Additionally, qualitative insights from entrepreneurs, policymakers, and institutional actors could complement quantitative findings and offer a richer understanding of how R&D transfer mechanisms function in practice. Finally, comparing perceived performance with innovation outcomes (e.g., patents, high-tech startups) could help bridge the gap between perception and measurable impact.

REFERENCES

Akhavan, P., Hosseini, S. M., Abbasi, M., & Manteghi, M. (2015). ***Knowledge-sharing determinants, behaviors, and innovative work behaviors: An integrated theoretical view and empirical examination.*** Aslib Journal of Information Management, 67(5), pp. 562–591.

Almaida, A., Kadir, A. R., & Sobarsyah, M. (2023). ***Building bridges of knowledge: Investigating the nexus of strategic alignment in university-industry collaborations.*** Migration Letters.

Argote, L. (2024). ***Knowledge transfer within organizations: mechanisms, motivation, and consideration***. Annual review of psychology, 75(1), pp. 405-431.

Argote, L., & Ingram, P. (2000). ***Knowledge transfer: A basis for competitive advantage in firms***. Organizational Behavior and Human Decision Processes, 82(1), 150-169.

Baba, A. (2024). ***Financing Innovation: The Role Of Funding In The Efficacy Of University Technology Transfer Entities.*** THE ANNALS OF THE UNIVERSITY OF ORADEA, 33(1st), pp. 223.

Ballesteros-Ballesteros, V. A., & Zárate-Torres, R. A. (2025). ***Mapping the Conceptual Structure of University–Industry Knowledge Transfer: A Co-Word Analysis***. Publications, *13*(1), pp. 8.

Bartlett, W., & Čučković, N. (2006). ***Knowledge transfer, institutions and innovation in Croatia and Slovenia.*** Društvena istraživanja, 15, pp. 371–399.

Bekkers, R., & Freitas, I. M. B. (2008). ***Analysing knowledge transfer channels between universities and industry: To what degree do sectors also matter?*** Research Policy, 37(10), pp. 1837–1853.

Berger, M., C. Criscuolo and A. Dechezleprêtre (2025), ***"Understanding Government Venture Capital: A primer and a taxonomy"***, OECD Science, Technology and Industry Working Papers, No. 2025/06, OECD Publishing, Paris, https://doi.org/10.1787/2157a5b3-en.

Berger, M., A. Dechezleprêtre and M. Fadic (2024), ***"What is the role of Government Venture Capital for innovation-driven entrepreneurship?"***, OECD Science, Technology and Industry Working Papers, No. 2024/10, OECD Publishing, Paris, https://doi.org/10.1787/6430069e-en.

Cummings, J. L., & Teng, B. S. (2003). ***Transferring R&D knowledge: the key factors affecting knowledge transfer success.*** Journal of Engineering and Technology Management, 20(1-2), pp. 39-68.

Etzkowitz, H. (1996). ***The triple helix: Academic-industry-government relations - implications for the New York regional innovation environment.*** Annals of the New York Academy of Sciences, 787(1), pp. 67-86.

Etzkowitz, H. (2003). ***Research groups as 'quasi-firms': the invention of the entrepreneurial university.*** Research Policy, 32(1), pp. 109-121.

Groenewegen, J., & Van der Steen, M. (2006). ***The evolution of national innovation systems.*** Journal of Economic Issues, 40(2), pp. 277-285.

Link, A. N., & Sarala, R. M. (2019). ***Advancing conceptualisation of university entrepreneurial ecosystems: The role of knowledge-intensive entrepreneurial firms.*** International Small Business Journal, 37(3), pp. 289-310.

Ockwell, D., Sagar, A., & De Coninck, H. (2015). ***Collaborative research and development (R&D) for climate technology transfer and uptake in developing countries: towards a needs driven approach.*** Climatic Change, 131, pp. 401-415.

Pece, A. M., Simona, O. E. O., & Salisteanu, F. (2015). ***Innovation and economic growth: An empirical analysis for CEE countries.*** Procedia Economics and Finance, 26, pp. 461-467.

Perkmann, M., Salandra, R., Tartari, V., McKelvey, M., & Hughes, A. (2021). ***Academic engagement: A review of the literature 2011-2019.*** Research policy, 50(1), pp. 104-114.

Pleśniarska, A. (2018). ***The Intensity of University-Business Collaboration in the EU. Acta Universitatis Lodziensis.*** Folia Oeconomica, 6(339), pp. 147-160.

Rinkinen, S., Konsti-Laakso, S., & Lahikainen, K. (2024). ***University as an opportunity space enabler in a regional entrepreneurial ecosystem.*** European Planning Studies, 32(5), pp. 1010-1028.

Sheng, M. L., Chang, S. Y., Teo, T., & Lin, Y. F. (2013). ***Knowledge barriers, knowledge transfer, and innovation competitive advantage in healthcare settings.*** Management Decision, 51(3), pp. 461-478.

Solow, R. M. (1956). ***A contribution to the theory of economic growth.*** The Quarterly Journal of Economics, 70(1), pp. 65-94.

Thomas, A., & Paul, J. (2019). ***Knowledge transfer and innovation through university-industry partnership: an integrated theoretical view.*** Knowledge Management Research & Practice, 17(4), pp. 436-448.

Tijssen, R. J. (2006). ***Universities and industrially relevant science: Towards measurement models and indicators of entrepreneurial orientation.*** Research Policy, 35(10), pp. 1569-1585.
Official page ***VESNA Venture Fond***, available at: https://vesnavc.com/ (accessed 7 April 2025)

A scientific paper

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A BIBLIOMETRIC ANALYSIS OF SHORT SELLING: CURRENT, DEVELOPMENT AND FUTURE DIMENSIONS

ABSTRACT

Particularly after the 2000s, interest in the concept of "short selling" has significantly increased. The multifaceted nature of short selling—encompassing aspects such as pricing, market efficiency, and regulation—has further elevated its importance. This study conducts a bibliometric analysis to explore the academic evolution of the short selling concept. Relevant studies published between 1980 and 2023 were retrieved from the Web of Science database. The intellectual structure and bibliographic features of the selected articles were analyzed using VOSviewer and the Bibliometrix R package. Various inclusion and exclusion criteria were applied to ensure the accuracy of the results. The current state of short selling over the specified period is presented, and future projections are discussed. Thus, this study serves as a preliminary effort to examine the development of scholarly work on short selling. In this respect, it contributes to the literature and encourages further research on this topic.

Key words: *Short Selling, Bibliometric analysis, Science mapping.*

1. Introduction and theoretical background

Short selling refers to the act of selling or placing an order to sell securities that the investor does not own. The investor aims to profit from a subsequent decline in the asset's price by repurchasing it at a lower cost. Short selling is often prohibited in financial markets due to its potential to cause manipulation. These transactions gained particular significance following the 2008 financial crisis. In response to financial crises, regulatory authorities often ban or restrict short selling (Beber & Pagano, 2013).

While governments, market regulators, and media outlets frequently blame short sellers for market declines, another perspective argues that short selling corrects mispricing and enhances market efficiency. Literature suggests that restrictions on short selling tend to reduce market liquidity, drive arbitrageurs away, cause overvaluation of stocks, and impair price efficiency (Sobacı et al., 2014).

The roots of modern short selling regulation trace back to the SEC's 1938 "uptick rule," enacted in the aftermath of the 1929 Great Depression. After the 2008 crisis—triggered by the collapse of Lehman Brothers on September 15, 2008—short selling came under intense scrutiny. Emergency restrictions were implemented by the SEC on September 19, 2008, and similar measures followed in the UK, Canada, and Switzerland. Later, Australia, EU countries, Russia, Southeast Asia, India, and Japan adopted comparable restrictions. Between July 2008 and June 2010, short selling restrictions were enforced in 56 countries (Eken, 2020).

Following the COVID-19 outbreak, the debate over short selling resurfaced. While some European countries imposed restrictions to prevent further market declines, increase in volatility, unethical investor behavior, and maintain financial stability, others refrained from doing so (Bessler & Vendrasco, 2022).

Academic findings on short selling restrictions during previous crises generally highlight their negative effects on market quality (Beber & Pagano, 2013; Jain et al., 2013; Pagano, 2020; Bessler & Vendrasco, 2022). Notably, the U.S. opted against similar restrictions during the COVID-19 pandemic, while some European countries adopted interventionist policies. Once market volatility subsided, many regulators lifted restrictions either fully or partially, sending a message that such measures could be reinstated if needed. For instance, the European Securities and Markets Authority (ESMA) has stated that restrictions may be re-applied when necessary (Securities Lending Times, 2020). Toward the end of 2020, South Korea's Financial Services Commission (FSC) announced that penalties for illegal short sales could rise to 500 million KRW (approx. 457,000 USD), including a minimum one-year prison sentence or fines (Securities Lending Times, 2020).

The impact of short selling on market dynamics remains a contentious issue. Especially post-2008, discussions and regulatory actions related to short selling have intensified. These developments have attracted scholarly attention to the topic.
International literature contains various studies on the effects of short selling on financial markets. Empirical research generally supports the view that short selling restrictions lead to inflated asset prices (Jones & Lamont, 2002; Lamont & Thaler, 2003; Chang et al., 2007; Boehmer & Wu, 2013; Ding et al., 2020). Some studies, however, claim that such restrictions do not significantly affect stock prices (Marsh & Payne, 2012; Boehmer et al., 2013). Additionally, market efficiency, returns, and volatility are all influenced by short selling (Henry & McKenzie, 2006; Jung et al., 2013; Boehmer et al., 2013; Li et al., 2018; Bohl et al., 2016; Mertzanis, 2017). Several studies also indicate that lifting restrictions on short selling can lead to negative returns (Morck et al., 2000; Ofek & Richardson, 2003; Bris et al., 2007; Ebrahimnejad & Hosainzade, 2019; Al-Awadhi et al., 2020; Onali, 2020; Alfora et al., 2020; Ashraf, 2020; Şahin & Kuz, 2021). A commonly accepted view is that short selling restrictions reduce market liquidity (Chen & Zheng, 2009; Li et al., 2018).
The primary function of organized stock exchanges is to instantly and fully reflect all information affecting asset prices, minimize transaction costs, and ensure a fair and orderly trading environment. This should hold true both during normal economic periods and in times of crisis (e.g., the 1929 Great Depression, the 2008 crisis, or the COVID-19 pandemic). Hence, it is crucial to determine whether market interventions such as trading restrictions are necessary during times of turmoil.

Given the rising number of publications on short selling, there is a growing need for a quantitative evaluation to map academic progress. Bibliometric analysis provides such an opportunity.

First introduced by Pritchard in 1969, bibliometric analysis is a scientific method for understanding the temporal evolution of a research field from a multidisciplinary perspective (Caviggioli & Ughetto, 2019). Its academic relevance has grown in recent years, aided by tools like VOSviewer, Leximancer, and Gephi, and databases such as Scopus and Web of Science (Donthu et al., 2020; Wang et al., 2020; Tandon et al., 2021; Donthu et al., 2021; Kokol et al., 2021; Khan et al., 2021).

Bibliometric analysis enables a deep understanding of a topic, mapping its boundaries and identifying future research avenues (Albort-Morant et al., 2017; Xu et al., 2018; Skute et al., 2019; Donthu et al., 2020). Its application is not a passing trend; it is increasingly preferred due to its ability to decipher large volumes of unstructured data and map evolving research landscapes (Verma & Gustafsson, 2020; Donthu et al., 2021a). It has been widely used in various disciplines including production (Caviggioli & Ughetto, 2019; Sahoo, 2022), management (Ferreira, 2018; Martínez-López, 2020), marketing (Gurzki & Woisetschlager, 2017; Nicolas et al., 2020), and innovation (Li et al., 2018; Huang et al., 2019).

Theoretically, this study addresses a gap by evaluating short-selling research indexed in the WoS database using bibliometric methods. Practically, it provides valuable insights for researchers by offering a comprehensive view of the literature on short selling. By categorizing key themes, this study helps outline research directions and trends. Specifically, it answers questions related to the publication years, journal distributions, most frequently used keywords, their co-occurrence patterns, contributing countries, and the most cited works in the field. To the best of the authors' knowledge, no other study has employed bibliometric analysis on short selling at this level of scope.
The remainder of the paper is structured as follows: Chapter 2 details the methodological approach; Section 3 presents the bibliometric analysis results; and Chapter 4 offers conclusions and directions for future research.

2. Methods

This study focuses on short-selling transactions, which tend to become particularly prominent during periods of financial crisis. The methodological approach adopted in this research is similar to that employed by Jiang et al. (2022) and Caby (2020). Building upon these studies, a comprehensive set of articles related to short selling was identified, reviewed, and refined to construct a suitable dataset. Consequently, this paper aims to explore how academic research on short selling has evolved over time and to identify potential directions for its future development.

2.1. Database curation

Because journal articles are peer-reviewed and represent certified sources of academic information, their findings are generally considered more reliable (Ramos-Rodriguez & Ruiz-Navarro, 2004). For this reason, news articles, reports, minutes, and other document types available in databases were excluded from the analysis; only peer-reviewed journal articles were considered.

Although there are numerous databases that collect global research outputs, this study utilizes the Web of Science (WoS) online database, which hosts scientific publications from a broad range of disciplines. Web of Science is widely accepted as a reliable and high-quality database

among bibliometric researchers. Due to its comprehensive coverage and rigorous indexing standards, it has become a primary tool for retrieving and evaluating academic publications and journals (Tandon et al., 2021; Sarkar et al., 2022; Chen et al., 2022; Park & Jeon, 2023). WoS provides a variety of essential data for bibliometric analysis, including references, abstracts, citation counts, authors' affiliations, and countries. In this regard, bibliometric analysis represents a methodological advancement over traditional literature reviews (De Bakker et al., 2005).

The dataset for this study was obtained from Web of Science on October 3, 2023. A total of 981 English-language articles published between 1980 and September 2023 were included in the analysis. This constitutes a limitation of the study. The reason for selecting Web of Science as the data source lies in its widespread acceptance and frequent use in academic research. The term "short selling" was used as the keyword in the search. The search targeted instances where "short selling" appeared in the title, abstract, and/or keywords. Quotation marks were used to ensure the precision of search results by capturing exact matches and related word combinations. This approach enhances the robustness of the dataset (Liu & Oakland, 2016).

During the initial testing phase, it was observed that many articles retrieved without applying subject area filters were not relevant to the topic. Therefore, articles were filtered, and those classified in unrelated categories were excluded. The remaining articles were manually reviewed to ensure thematic relevance. As a result, a general research dataset on short selling was compiled without focusing on specific subtopics or publication types.

The bibliometric method used in this study involves the assessment of the volume of publications and the identification of emerging trends in the literature. For this purpose, the software tools **VOSviewer** and **Biblioshiny** were employed to analyze the academic studies and generate a comprehensive bibliometric mapping (Ejaz et al., 2022). These tools were selected for their ability to process scientific data and create insightful visual representations of the research landscape.

Science mapping refers to the process of analyzing and visualizing the intellectual structure of a scientific field. It allows for the identification of key trends and patterns in bibliographic data and in the broader academic literature (Bornmann et al., 2011). Various science mapping tools exist, each with distinct capabilities and limitations. Some of the most commonly used tools include **VOSviewer**, **R-Bibliometrix (Biblioshiny)**, **Gephi**, **CiteSpace**, **BibExcel**, **CitNetExplorer**, and **VantagePoint**. For this study, **R-Bibliometrix** (Aria & Cuccurullo, 2017) and **VOSviewer** (Van Eck & Waltman, 2010) were chosen due to their efficiency in creating and visualizing bibliometric networks. R-Bibliometrix is an R package designed to perform quantitative analysis in scientific research and to generate detailed bibliometric and science mapping outputs.

More specifically, a performance analysis was carried out, incorporating bibliometric data such as the number of citations, distribution of articles across journals, contributing countries, key authors, and affiliated institutions (Cobo et al., 2011; Gaviria-Marin et al., 2018; Donthu et al., 2021). This bibliometric analysis was complemented with content analysis.

In this study, both **relational** and **descriptive** bibliometric techniques and indicators were employed. Factors such as language, country, and institutional affiliation offer sociocultural and demographic context. Mapping the density of publications over time provides a visual illustration of the historical development of research in the field. Keywords, as designated by

the authors, help to classify concepts and clarify how these concepts are interrelated, as well as which areas have been thoroughly investigated and which remain underexplored. Identifying the most prolific authors and journals reveals who has contributed the most and where these studies were predominantly published. Author collaboration analysis sheds light on the structure of scholarly networks, while citation metrics reveal the intellectual foundations of the field. Finally, bibliometric maps offer a clear depiction of historical research trajectories and scholarly communities, outlining possible directions for future inquiry.

3. Findings

Bibliometric analysis techniques can be categorized into two main groups: science mapping and performance analysis. While performance analysis evaluates the individual contributions of research constituents (e.g., authors, institutions, countries, journals), science mapping focuses on the interrelationships among these components and aims to uncover the intellectual and conceptual structure of a research field (Donthu et al., 2021).

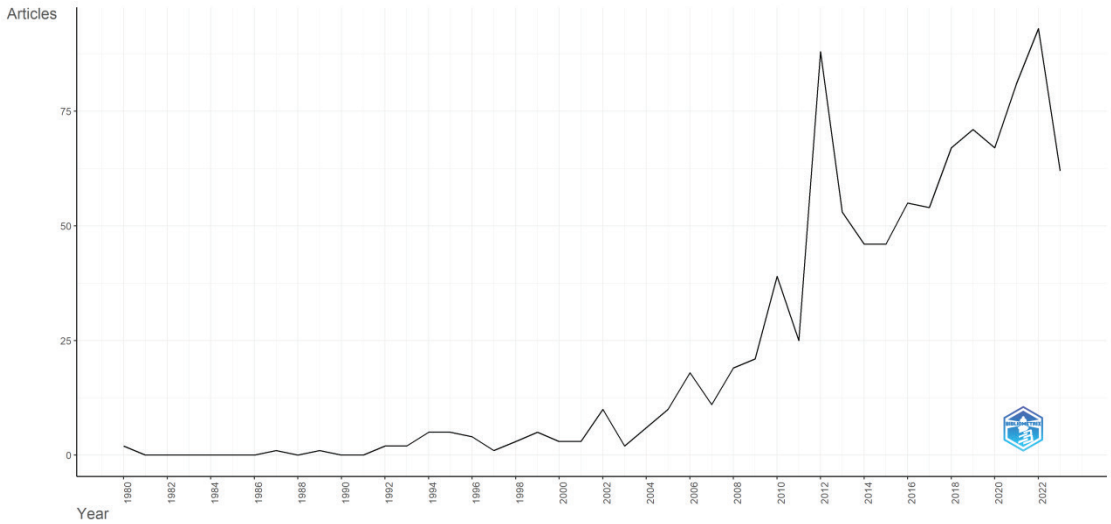
3.1. Performance Analysis

A performance analysis was conducted to gain a comprehensive understanding of the academic output on the topic. In this section, the results are presented under three primary categories: (1) publication output and growth trends, (2) journal analysis, and (3) citation analysis.

3.1.1. Publication Output and Growth Trends

The number of peer-reviewed publications serves as a key indicator of the maturity and developmental trajectory of any academic discipline. Figure 1 illustrates the annual distribution of articles related to short selling, published between 1980 and September 2023, and indexed in the Web of Science database.

Figure 1: Short Selling Articles by Years



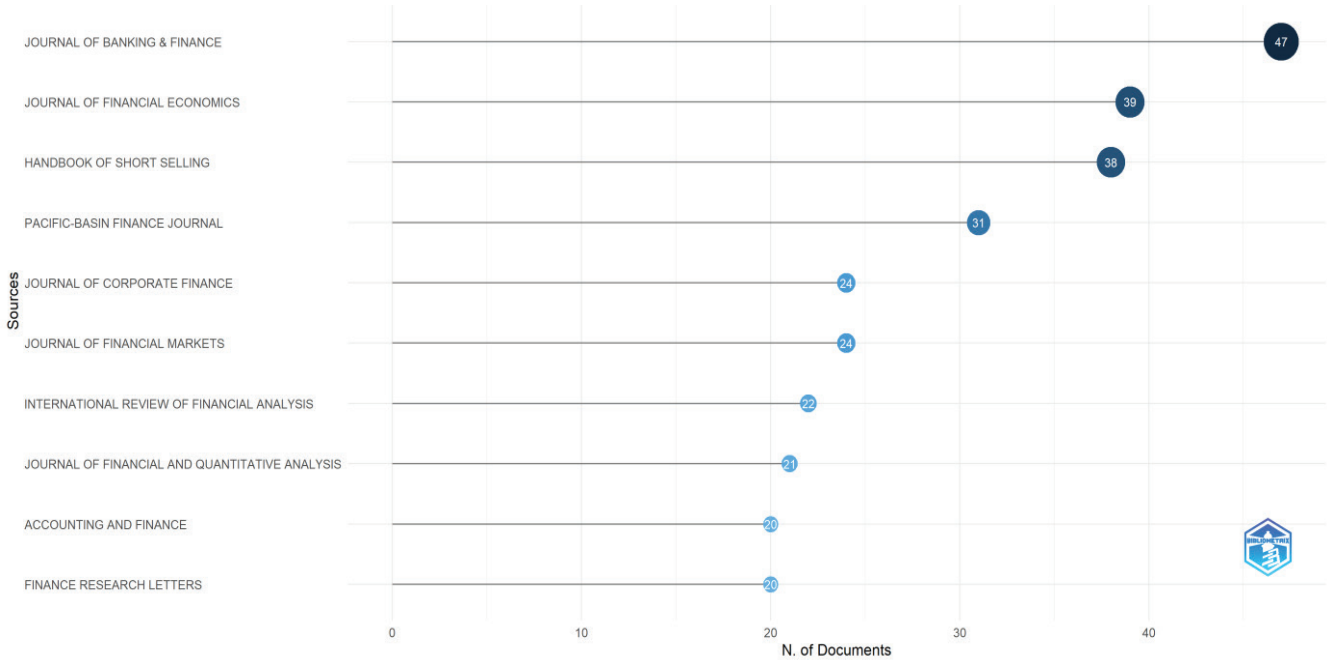
Source: Authors

It can be seen that short-selling research started in 1980. Therefore, studies conducted between 1980 and 2023 (September) are included in the scope of bibliometric analysis. When we look at the publication years of studies on short selling, it is seen that the subject has been studied with increasing momentum after 2004. It is observed that this increase was much higher in 2010 than in other years. The characteristic of 2010 is thought to be the impact of the global crisis. The activity/volatility experienced in the stock markets during global crisis periods brings the interest in short selling or the regulations on this issue to the agenda.

3.1.2. Journal analysis

Table 2 presents the ranking of journals that have published research related to short selling. Figure 2 illustrates the ranking of journals within the Web of Science database that have published at least twenty articles on the topic.

Figure 2: Journals on Short Selling



Source: Authors

An examination of the journals that have published research on short selling reveals that nearly all of them fall within the Q1 category. However, the disparity in the number of publications across journals is noteworthy and holds particular significance for researchers intending to publish in this area. The Journal of Banking & Finance emerges as the leading journal in terms of the number of short selling-related publications worldwide. The dominance of finance-focused journals in this domain indicates that the topic of short selling has largely remained within the boundaries of financial research and has yet to expand significantly into other academic disciplines.

3.1.3. Citation Analysis

Citations to a research article serve as indicators of its overall impact, quality, and contribution to the academic field. From this perspective, it can be argued that frequently cited articles exert

a greater influence compared to those with fewer or no citations (Culnan, 1986). Table 1 presents the most frequently cited papers in the area of short selling.

Table 1: Most cited papers

Article Title and Year	Authors	Journal	Journal Classification	Citations	Keywords
Constraints on short-selling and asset price adjustment to private information (1987)	Diamond and Verrecchia	Journal of Financial Economics	Financial economics	767	n. a.
Short sales, institutional investors, and the cross-section of stock returns (2005)	Nagel	Journal of Financial Economics	Financial economics	468	Return predictability, Short-sales constraints, Institutional investors
Short interest, institutional ownership, and stock returns (2005)	Asquith et al..	Journal of Financial Economics	Financial economics	414	Short sales, Short interest, Limits to arbitrage
Efficiency and the bear: Short sales and markets around the World (2007)	Bris et al..	The Journal of Finance	Finance, economics, business	362	n. a.
Short-sale constraints and stock returns (2002)	Jones and Lamont	Journal of Financial Economics	Financial economics	357	Mispricing, Short selling, Short sale constraints, Securities lending
Short-sale strategies and return predictability (2009)	Diether et al..	Review of Financial Studies	Finance	346	n. a.
Institutional investors and the informational efficiency of prices (2009)	Boehmer and Kelley	The Review of Financial Studies	Finance	326	n. a.
Rational contagion and the globalization of securities markets (2000)	Calvo and Mendoza	Journal of International Economics	Economy	321	n. a.
Short selling and the price discovery process (2013)	Boehmer and Wu	The Review of Financial Studies	Finance	298	n. a.
Short-selling bans around the world: Evidence from the 2007–09 crisis (2013)	Beber and Pagano	The Journal of Finance	Finance, economics, business	272	n. a.

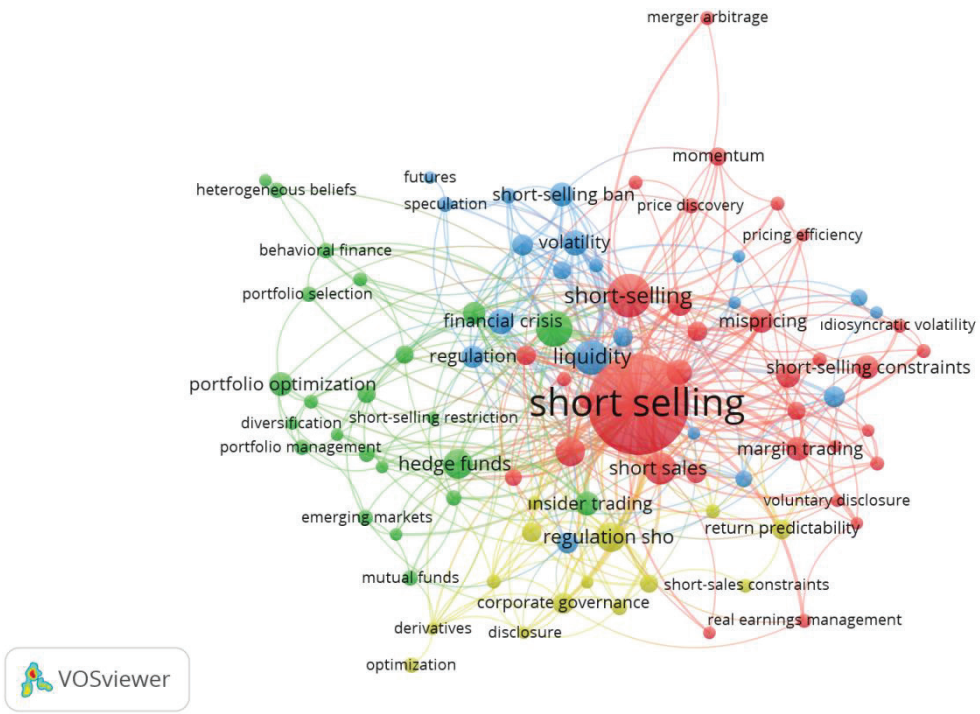
Source: Authors

Table 1 displays the ten most cited studies within the scope of this research, covering the period under consideration. A review of these top-cited studies on short selling reveals that they have received substantial academic attention. The most cited work is by Diamond and Verrecchia (1987), with a total of 767 citations. The diversity of the sources from which these studies originate highlights the interdisciplinary relevance of the short selling topic, although it remains predominantly situated within the domain of financial journals.

3.2. Science Mapping

This section presents a graphical visualization of keyword co-occurrence to offer a detailed depiction of the thematic landscape. The term co-occurrence refers to the frequency with which a keyword appears alongside other keywords in the same study (Isenberg et al., 2016; Farrukh et al., 2020; Han & Gupta, 2022). Co-word analysis is employed to examine how keywords are used together in studies that aim to map the intellectual structure of a specific research area. In addition, homophone analysis—a form of quantitative content analysis—investigates the frequency and relationships of homophonous or semantically similar terms within academic publications. The terms used in synonym analysis are derived from "author keywords," which reflect how authors classify and conceptualize their work.

Figure 3: Keyword Map



Source: Authors

Analyzing the keywords of the selected studies provides insights into the conceptual foundations of the short-selling phenomenon and offers valuable information to relevant stakeholders. In this context, commonly recurring keywords include concepts such as liquidity, margin trading, constraints, mispricing, regulation, financial crisis, and insider trading. In contrast, terms like merger arbitrage, portfolio optimization, mutual funds, and derivatives appear less frequently among the keywords. This indicates that the concept of short selling is not only of interest to investors but also to policymakers and regulatory bodies.

To uncover a network representation of related research themes, a clustering analysis based on keyword co-occurrence was conducted using VOSviewer. This analysis aimed to identify research trends among the 981 articles included in the sample. The resulting clusters are grouped into four categories, each labeled by representative keywords. As shown in Table 2, the clusters vary in terms of the number of keywords they contain and the thematic areas they encompass.

Each cluster is visually represented in a distinct color. These clusters consist of tightly connected nodes (keywords), where the connecting lines signify co-occurrence relationships (see Figure 3). The circular size of each keyword reflects its relative importance within the dataset. Furthermore, a smaller distance between circles indicates a stronger conceptual relationship (Van Eck & Waltman, 2014).

To identify the main research streams within the short-selling literature, a comprehensive content analysis was performed on the 981 articles grouped across the four keyword clusters. After detailed examination of each cluster, a central thematic focus was identified for each.

Table 2: An integrative framework for the short-selling studies

Cluster No-Color	Most frequently used keywords index (n > 4)	Focus Area
Cluster 1 – Red	Arbitrage (26), China (11), Chinese stock market (9), credit default swaps (5), exchange-traded funds (12), financial constraints (4), idiosyncratic volatility (7), investor sentiment (8), Korean stock market (7), limits to arbitrage (15), margin trading (27), merger arbitrage (4), mispricing (28), momentum (8), options (11), overvaluation (12), price discovery (10), price efficiency (15), pricing (9), pricing efficiency (7), real earnings management (8), securities lending (21), short interest (34), short sale (12), short sales (29), short selling (256), short-selling constraints (28), stock liquidity (7), stock price crash risk (8), voluntary disclosure (7), weekend effect (7)	Pricing and volatility (with a focus on arbitrage and risk)
Cluster 2 – Green	Asset pricing (8), asymmetric information (8), behavioral finance (9), emerging markets (6), financial markets (8), financial regulation (8), hedge funds (27), hedging (7), insider trading (20), market efficiency (53), market microstructure (8), mutual funds (6), portfolio analysis (7), portfolio management (6), portfolio optimization (7), portfolio selection (6), short sale constraints (17), short-selling restriction (6), skewness (5), united states of America (9)	Mitigation (with a focus on risk) and portfolio diversification
Cluster 3 – Blue	COVID-19 (6), earnings announcements (15), financial crisis (29), informed trading (8), liquidity (53), market quality (23), private information (13), regulation (24), short sellers (11), short-sale ban (7), short-selling ban (18), short-selling restrictions (6), speculation (9), stock returns (16), trading volume (10), transaction costs (6), uncertainty (6), volatility (29)	Adaptation (with a focus on financial crises, constraints, and uncertainty)
Cluster 4 – Yellow	Corporate governance (16), derivatives (12), disclosure (11), dividends (8), equity lending (10), global financial crisis (11), information asymmetry (11), naked short selling (14), regulation sho (35), return predictability (11), securities and exchange (12), uptick rule (15)	Management's contribution to short selling

Source: Authors

An examination of the table reveals that across nearly all cluster categories, the relationship between short selling and themes such as regulation/restriction, product pricing, and market efficiency has been frequently studied. Notably, the U.S. and Chinese markets—arguably the largest stock markets in the world—stand out in terms of research focus.

Cluster 1 comprises studies that primarily address issues of pricing, arbitrage, and volatility driven by risk factors. These studies investigate the effects of short-selling practices on pricing and volatility, with a particular emphasis on the Chinese and Korean stock markets. Some studies also explore the weekend effect on pricing and risk. Overall, Cluster 1 centers on themes such as short-selling activities, investor sentiment toward publicly traded stocks, mispricing, options, arbitrage, and their implications for volatility.

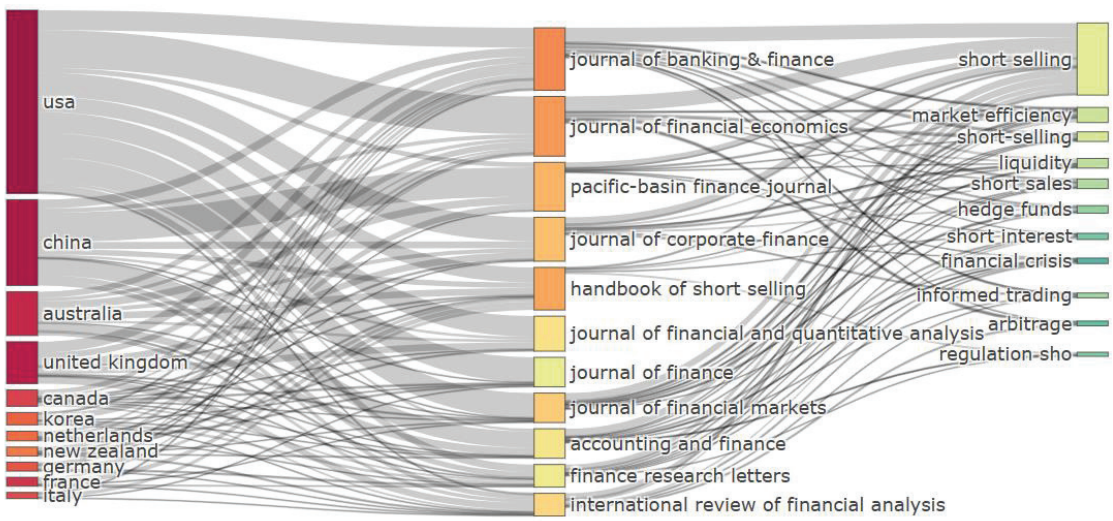
Cluster 2 places market efficiency at the forefront. The articles grouped under this cluster examine the negative consequences of short-selling practices on financial markets. These studies address topics including hedge funds, insider trading, portfolio selection, behavioral finance, asymmetric information, and hedging strategies. Additionally, this cluster explores the role of financial regulation in mitigating the adverse effects of short selling, particularly within the U.S. and emerging markets.

Cluster 3 focuses on short-selling practices during the COVID-19 pandemic, which represents a recent global financial crisis. The central theme in this cluster is liquidity. The articles investigate the effects of short selling—particularly during periods of financial turmoil—on liquidity, volatility, stock returns, and overall market quality. Furthermore, the effectiveness of financial regulations in addressing these challenges is also evaluated.

Cluster 4 includes studies that explore the role of management and coordination in facilitating the integration of short-selling practices into market mechanisms. These studies examine institutional and regulatory approaches to harmonizing short selling with broader financial system stability.

Figure 4 presents the output of the Biblioshiny/Bibliometrix analysis, highlighting three correlation plots that illustrate the relationships between countries, journals, and keywords.

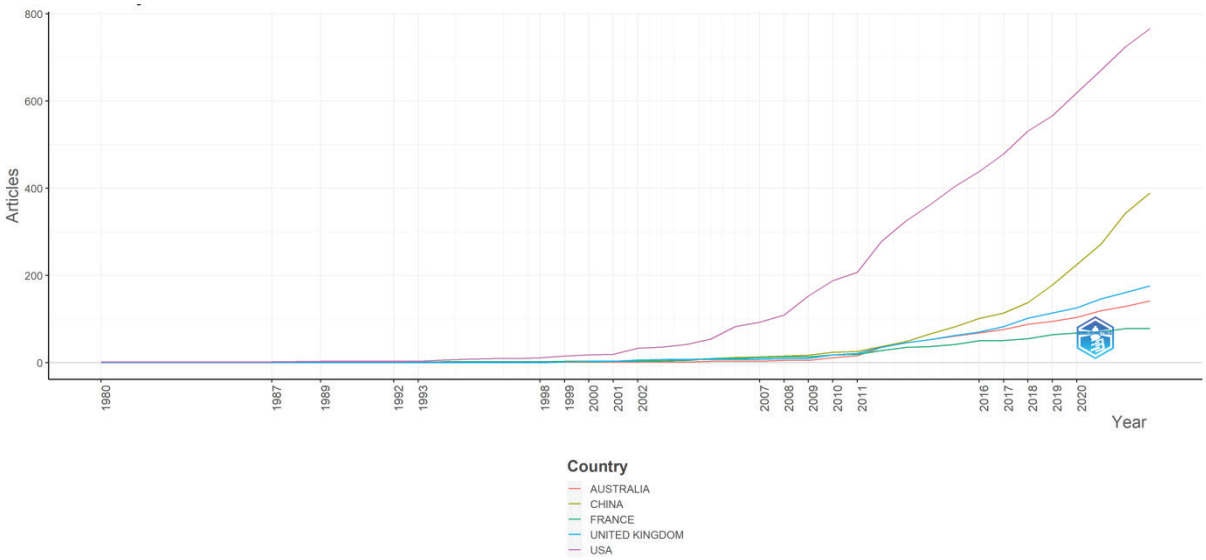
Figure 4: Relationships among countries, journals, and keywords



Source: Authors

In figure 5, it can be statistics withe related countries.

Figure 5: Country Production over Time



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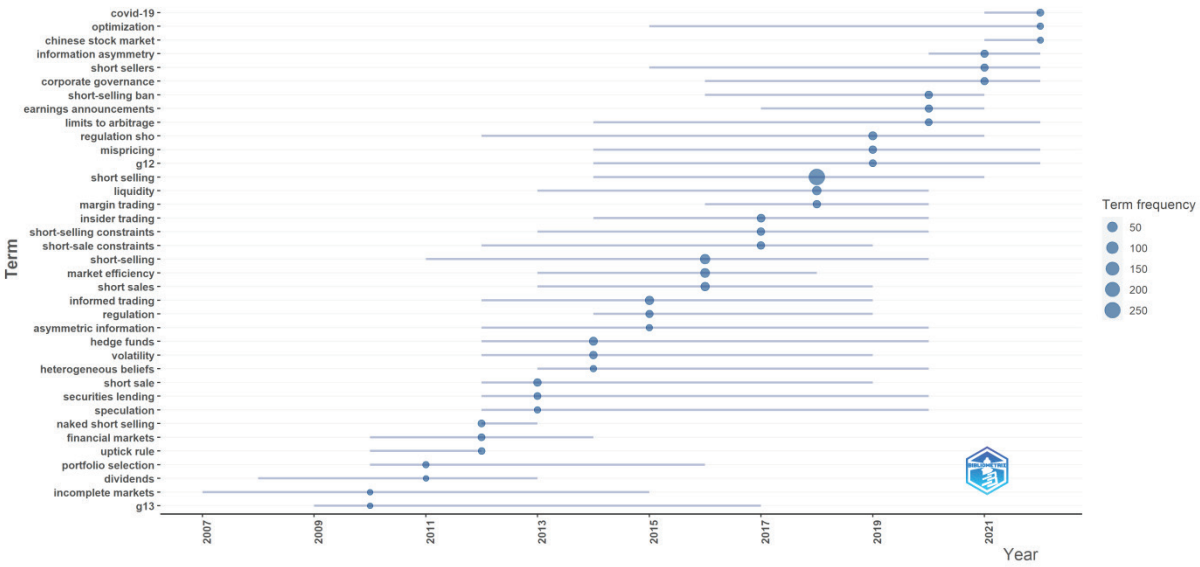
Source: Authors

The connections between the elements are represented in a nested rectangular structure in Figure 4. The larger the size of each rectangle, the greater the number of associated articles, authors, or keywords. Figure 4 presents a three-factor analysis depicting the relationships among countries (left), journals (center), and keywords (right). Five countries—the United States, China, Australia, United Kingdom, and Canada—have made the most significant contributions to the short-selling literature. These contributions are predominantly associated with four primary keywords: short selling, market efficiency, liquidity, and short sales. A strong relationship is observed between these countries, keywords, and five major journals: Journal of Banking & Finance, Journal of Financial Economics, Pacific-Basin Finance Journal, Journal of Corporate Finance, and Handbook of Short Selling.

In summary, the analysis of country-journal-keyword relationships in short-selling studies reveals that the field is primarily dominated by developed countries. The majority of the publications appear in finance-oriented journals, and the central themes revolve around financial crises, market efficiency, and liquidity.
Figure 5 illustrates that scholarly interest in short selling increased notably in the United States following the 2008–2009 global financial crisis. In more recent years, research on this topic has gained momentum in China, yet overall, the field continues to be primarily explored by developed economies.

Figure 6: Trend Topics



Source: Authors

Figure 6 illustrates a thematic evolution in the short-selling literature over time. Earlier studies focused on topics such as naked short selling, financial markets, the uptick rule, portfolio selection, dividends, and incomplete markets. These earlier themes have gradually been replaced by more contemporary research interests including speculation, securities lending, heterogeneous beliefs, volatility, hedge funds, regulation, mispricing, arbitrage, informed trading, market efficiency, insider trading, margin trading, liquidity, corporate governance, optimization, Regulation SHO, and earnings announcements. These topics have consistently been examined through the lens of short-selling practices.
In recent years, however, emerging themes such as the Chinese stock market, the COVID-19 pandemic, and information asymmetry have come to the forefront of the literature, reflecting the evolving dynamics and relevance of short selling in response to global economic developments.

4. Conclusıon

Short selling encompasses financial activities related to stock price movements, volatility in prices and returns, risk, and market efficiency. This study conducted a ranking analysis and provided visual illustrations based on key bibliometric criteria, such as citation counts, journal distribution, and keyword usage. These findings contribute to a deeper understanding of the current positioning and scholarly development of the short selling topic.

Using a bibliometric approach, this article examines the development and emerging trends in academic studies on short selling published between 1980 and September 2023. The research was based on a dataset of 981 articles retrieved from the Web of Science database, selected through defined inclusion and exclusion criteria. The analysis reveals that academic interest in short selling and short-selling restrictions tends to intensify during periods of financial crisis.

A notable increase in publication momentum began after 2004, with another spike occurring during the 2008–2012 global financial crisis. Following a period of steady growth from 2014 onward, the field experienced a significant surge in 2020, largely driven by the onset of the

COVID-19 pandemic—a modern global crisis that brought short-selling restrictions back to the forefront of financial regulation debates. The year 2022 marked the peak in terms of the number of publications on the topic.

The results also indicate that developed countries dominate academic contributions to the field. The United States and China rank first and second, respectively, in terms of total number of publications. In terms of journal output, the Journal of Banking & Finance, Journal of Financial Economics, and Pacific-Basin Finance Journal are the leading platforms for short selling research.

Thematic and trend analyses of author keywords underscore the evolution of research interests within the short selling domain. While several core topics have been extensively studied, the keyword analysis reveals emerging areas—particularly regarding information asymmetry, the Chinese and U.S. stock markets, and regulatory impacts—that hold promise for future research. The findings suggest that short selling has increasingly been explored as a mechanism for mitigating risk and price volatility, especially in times of economic uncertainty.

One notable observation is the geographic concentration of research samples, primarily centered on the U.S. and Chinese markets. This highlights an opportunity for future studies to broaden their scope by incorporating samples from other countries and regions, potentially diversifying perspectives on short selling practices.

This bibliometric study was designed with academics, financial experts, and policy-makers in mind. To the best of the authors' knowledge, it represents one of the most comprehensive bibliometric analyses of short selling in the literature to date. By mapping the intellectual structure of the field, the study offers new insights and research directions for scholars. The longitudinal examination of keywords helps identify research hot spots and areas of sustained interest, while the list of most cited articles serves to highlight the most influential works in the field.

The observation that nearly all studies are published in leading finance journals, combined with the relatively limited exploration of regulatory and restriction-related dimensions, suggests potential for future contributions in interdisciplinary journals. In addition, future bibliometric studies could be enhanced by incorporating data from other academic databases such as Scopus, thereby providing a broader and more diverse overview of the literature.

REFERENCES

Al-Awadhi, A. M., Alsaifi, K., Al-Awadhi, A., & Alhammadi, S. (2020): ***Death and contagious infectious diseases: Impact of the COVID-19 virus on stock market returns***. *Journal of behavioral and experimental finance*, *27*, 100326.

Albort-Morant, G., Henseler, J., Leal-Millán, A., & Cepeda-Carrión, G. (2017): ***Mapping the field: A bibliometric analysis of green innovation.*** Sustainability, 9(6), 1011.

Alfaro, L., Chari, A., Greenland, A. N., & Schott, P. K. (2020): ***Aggregate and firm-level stock returns during pandemics, in real time*** (No. w26950). National Bureau of Economic Research.

Aria, M., & Cuccurullo, C. (2017): ***bibliometrix: An R-tool for comprehensive science mapping analysis***. *Journal of informetrics*, *11*(4), 959-975.

Ashraf, B. N. (2020): ***Stock markets' reaction to COVID-19: Cases or fatalities?.*** *Research in international business and finance*, *54*, 101249.

Asquith, P., Pathak, P. A., & Ritter, J. R. (2005): ***Short interest, institutional ownership, and stock returns.*** *Journal of Financial Economics*, *78*(2), 243-276.

Baker, S. R., Bloom, N., Davis, S. J., Kost, K., Sammon, M., & Viratyosin, T. (2020): ***The unprecedented stock market reaction to COVID-19.*** *The review of asset pricing studies*, *10*(4), 742-758.

Beber, A., & Pagano, M. (2013): ***Short-selling bans around the world: Evidence from the 2007–09 crisis***. *The Journal of Finance*, *68*(1), 343-381.

Bessler, W., & Vendrasco, M. (2022): ***Short-selling restrictions and financial stability in Europe: Evidence from the Covid-19 crisis.*** *Journal of International Financial Markets, Institutions and Money*, *80*, 101612.

Boehmer, E., & Kelley, E. K. (2009): ***Institutional investors and the informational efficiency of prices.*** *The Review of Financial Studies*, *22*(9), 3563-3594.

Boehmer, E., Jones, C. M., & Zhang, X. (2013): ***Shackling short sellers: The 2008 shorting ban***. *The Review of Financial Studies*, *26*(6), 1363-1400.

Boehme, R. D., Danielsen, B. R., & Sorescu, S. M. (2006): ***Short-sale constraints, differences of opinion, and overvaluation***. *Journal of Financial and Quantitative Analysis*, *41*(2), 455-487.

Boehmer, E., & Wu, J. (2013): ***Short selling and the price discovery process.*** *The Review of Financial Studies*, *26*(2), 287-322.

Bohl, M. T., Reher, G., & Wilfling, B. (2016): ***Short selling constraints and stock returns volatility: Empirical evidence from the German stock market.*** *Economic Modelling*, *58*, 159-166.

Boehmer, E., & Wu, J. (2013): ***Short selling and the price discovery process***. *The Review of Financial Studies*, *26*(2), 287-322.

Bornmann, L., Leydesdorff, L., Walch-Solimena, C., & Ettl, C. (2011): ***Mapping excellence in the geography of science: An approach based on Scopus data.*** *Journal of Informetrics*, *5*(4), 537-546.

Bris, A., Goetzmann, W. N., & Zhu, N. (2007): ***Efficiency and the bear: Short sales and markets around the world.*** *The Journal of Finance*, *62*(3), 1029-1079.

Calvo, G. A., & Mendoza, E. G. (2000): ***Rational contagion and the globalization of securities markets.*** *Journal of international economics*, *51*(1), 79-113.

Caviggioli, F., & Ughetto, E. (2019): ***A bibliometric analysis of the research dealing with the impact of additive manufacturing on industry, business and society***. *International journal of production economics*, *208*, 254-268.

Caby, J. (2020): ***The impact of short selling on firms: an empirical literature review***. *Journal of Business Accounting and Finance Perspectives*, *2*(3), 1-9.

Chang, E. C., Cheng, J. W., & Yu, Y. (2007): ***Short-sales constraints and price discovery: Evidence from the Hong Kong market.*** *The Journal of Finance*, *62*(5), 2097-2121.

Chen, M., & Zheng, Z. (2009): ***The impact of short selling on the volatility and liquidity of stock markets: Evidence from Hong Kong Market***. *Advances in Business Intelligence and Financial Engineering*, 252-258.

Chen, Y., Xiong, K., Ren, X., & Cheng, C. (2022): ***An overview of ecological vulnerability: A bibliometric analysis based on the Web of Science database.*** *Environmental Science and Pollution Research*, *29*(9), 12984-12996.

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011): ***An approach for detecting, quantifying, and visualizing the evolution of a research field: A practical application to the Fuzzy Sets Theory field***. *Journal of informetrics*, *5*(1), 146-166.

Culnan, M. J. (1986): ***The intellectual development of management information systems, 1972–1982: A co-citation analysis.*** *Management science*, *32*(2), 156-172.

De Bakker, F. G., Groenewegen, P., & Den Hond, F. (2005): ***A bibliometric analysis of 30 years of research and theory on corporate social responsibility and corporate social performance***. *Business & society*, *44*(3), 283-317.

Diamond, D. W., & Verrecchia, R. E. (1987): ***Constraints on short-selling and asset price adjustment to private information.*** *Journal of Financial Economics*, *18*(2), 277-311.

Diether, K. B., Lee, K. H., & Werner, I. M. (2009): ***Short-sale strategies and return predictability.*** *The Review of Financial Studies*, *22*(2), 575-607.

Donthu, N., Kumar, S., & Pattnaik, D. (2020): ***Forty-five years of Journal of Business Research: A bibliometric analysis.*** *Journal of business research*, *109*, 1-14.

Donthu, N., Kumar, S., Pandey, N., & Gupta, P. (2021): ***Forty years of the International Journal of Information Management: A bibliometric analysis.*** *International Journal of Information Management*, *57*, 102307.

Donthu, N., Kumar, S., Pandey, N., & Lim, W. M. (2021a): ***Research constituents, intellectual structure, and collaboration patterns in Journal of International Marketing: An analytical retrospective.*** *Journal of International Marketing*, *29*(2), 1-25.

Ebrahimnejad, A., & Hoseinzade, S. (2019): ***Short-sale constraints and stock price informativeness***. *Global Finance Journal*, *40*, 28-34.

Eken, T. (2013): ***Açığa Satış Kısıtlamaları ve Piyasa Etkinliği: Türkiye Üzerine Bir Çalışma (Short Selling Restrictions and Market Efficiency***: ***A Study on Turkey.*** *Available at SSRN 2361666*.

Ejaz, A., Ullah, A., Sikandar, H., Khan, N., & Hassan, M. (2022): ***Mapping the literature of social network ties in business and management field: A bibliometric study.*** *Journal of Management Info*, *9*(3), 330-346.

Farrukh, M., Meng, F., Wu, Y., & Nawaz, K. (2020): ***Twenty-eight years of business strategy and the environment research: A bibliometric analysis***. *Business Strategy and the Environment*, *29*(6), 2572-2582.

Ferreira, F. A. (2018): ***Mapping the field of arts-based management: Bibliographic coupling and co-citation analyses***. *Journal of Business Research*, *85*, 348-357.

Gaviria-Marin, M., Merigo, J. M., & Popa, S. (2018): ***Twenty years of the Journal of Knowledge Management: A bibliometric analysis.*** Journal of Knowledge Management, 22(8), 1655-1687.

Gurzki, H., & Woisetschläger, D. M. (2017): ***Mapping the luxury research landscape: A bibliometric citation analysis***. *Journal of business research*, *77*, 147-166.

Han, B., & Gupta, G. (2022): ***Automatic Keyword Extraction in Economic with Co-occurrence Matrix***. In Proceedings of Academia-Industry Consortium for Data Science: AICDS 2020 (pp. 407-415). Singapore: Springer Nature Singapore.

Henry, Ó. T., & McKenzie, M. (2006): ***The impact of short selling on the price-volume relationship: Evidence from Hong Kong***. *The Journal of Business*, *79*(2), 671-691.

Huang, Y., Ding, X. H., Liu, R., He, Y., & Wu, S. (2019): ***Reviewing the domain of technology and innovation management: A visualizing bibliometric analysis***. Sage Open, 9(2), 2158244019854644.

Isenberg, P., Isenberg, T., Sedlmair, M., Chen, J., & Möller, T. (2016): ***Visualization as seen through its research paper keywords***. IEEE Transactions on Visualization and Computer Graphics, 23(1), 771-780.

Jain, A., Jain, P. K., McInish, T. H., & McKenzie, M. (2013): ***Worldwide reach of short selling regulations***. Journal of Financial Economics, 109(1), 177-197.

Jones, C. M., & Lamont, O. A. (2002): ***Short-sale constraints and stock returns***. *Journal of Financial Economics*, *66*(2-3), 207-239.

Jiang, H., Habib, A., & Hasan, M. M. (2022): ***Short selling: A review of the literature and implications for future research***. *European Accounting Review*, *31*(1), 1-31.

Jung, C. S., Kim, W., & Lee, D. W. (2013): ***Short selling by individual investors: Destabilizing or price discovering?.*** *Pacific-Basin Finance Journal*, *21*(1), 1232-1248.

Khan, M. A., Pattnaik, D., Ashraf, R., Ali, I., Kumar, S., & Donthu, N. (2021): ***Value of special issues in the journal of business research: A bibliometric analysis***. *Journal of business research*, *125*, 295-313.

Kokol, P., Blažun Vošner, H., & Završnik, J. (2021): ***Application of bibliometrics in medicine: a historical bibliometrics analysis***. Health Information & Libraries Journal, 38(2), 125-138.

Lamont, O. A., & Thaler, R. H. (2003): ***Can the market add and subtract? Mispricing in tech stock carve-outs.*** *Journal of Political Economy*, *111*(2), 227-268.

Liu, S., & Oakland, T. (2016): ***The emergence and evolution of school psychology literature: A scientometric analysis from 1907 through 2014***. *School psychology quarterly*, *31*(1), 104.

Li, Z., Lin, B., Zhang, T., & Chen, C. (2018): ***Does short selling improve stock price efficiency and liquidity? Evidence from a natural experiment in China***. *The European Journal of Finance*, *24*(15), 1350-1368.

Li, M., Porter, A. L., & Suominen, A. (2018): ***Insights into relationships between disruptive technology/innovation and emerging technology: A bibliometric perspective***. *Technological Forecasting and Social Change*, *129*, 285-296.

Marsh, I. W., & Payne, R. (2012): ***Banning short sales and market quality: The UK's experience.*** *Journal of Banking & Finance*, *36*(7), 1975-1986.

Martínez-López, F. J., Merigó, J. M., Gázquez-Abad, J. C., & Ruiz-Real, J. L. (2020): ***Industrial marketing management: Bibliometric overview since its foundation***. Industrial Marketing Management, 84, 19-38.

Morck, R., Yeung, B., & Yu, W. (2000): ***The information content of stock markets: why do emerging markets have synchronous stock price movements?.*** *Journal of financial economics*, *58*(1-2), 215-260.

Mertzanis, C. (2017): ***Short selling regulation, return volatility and market volatility in the Athens Exchange***. *Studies in economics and finance*, *34*(1), 82-104.

Nagel, S. (2005): ***Short sales, institutional investors and the cross-section of stock returns.*** *Journal of financial economics*, *78*(2), 277-309.

Nicolas, C., Valenzuela-Fernández, L., & Merigó, J. M. (2020): ***Research trends of marketing: a bibliometric study 1990–2017***. Journal of Promotion Management, 26(5), 674-703.

Ofek, E., & Richardson, M. (2003): ***Dotcom mania: The rise and fall of internet stock prices.*** *the Journal of Finance*, *58*(3), 1113-1137.

Onali, E. (2020): ***Covid-19 and stock market volatility***. *Available at SSRN 3571453*.

Park, I., & Jeon, J. (2023, January): ***Psychological skills training for athletes in sports: web of science bibliometric analysis.*** In *Healthcare* (Vol. 11, No. 2, p. 259). MDPI.

Pagano, M., (2020): ***Should we ban short sales in a stock market crash? Oxford Business Law Blog,*** 13 March 2020, accessed on 15 October 2023, https://www.law.ox.ac.uk/business-law-blog/blog/2020/03/should-we-ban-short-sales-stock-market-crash.

Ramos-Rodríguez, A. R., & Ruíz-Navarro, J. (2004): ***Changes in the intellectual structure of strategic management research: A bibliometric study of the Strategic Management Journal***, 1980–2000. *Strategic management journal*, *25*(10), 981-1004.

Sahoo, S. (2022): ***Big data analytics in manufacturing: a bibliometric analysis of research in the field of business management***. International Journal of Production Research, 60(22), 6793-6821.

Sarkar, A., Wang, H., Rahman, A., Memon, W. H., & Qian, L. (2022): ***A bibliometric analysis of sustainable agriculture: based on the Web of Science (WOS) platform.*** *Environmental Science and Pollution Research*, *29*(26), 38928-38949.

Securities Lending Times, (2020): https://www.securitiesfinancetimes.com/securitieslendingnews/regulationarticle.php?article_id=224 404&navigationaction=regulationnews&page=1&newssection=regulation (Access Date: 20.10.2023)

Sobaci, C., Sensoy, A., & Erturk, M. (2014): ***Impact of short selling activity on market dynamics: Evidence from an emerging market.*** *Journal of Financial Stability*, *15*, 53-62.

Skute, I., Zalewska-Kurek, K., Hatak, I., & de Weerd-Nederhof, P. (2019): ***Mapping the field: a bibliometric analysis of the literature on university–industry collaborations***. The journal of technology transfer, 44, 916-947.

Şahin, B. C., & Kuz, F. (2021): ***The effects of short selling on price discovery: A study for Borsa Istanbul***. *Borsa Istanbul Review*, *21*(2), 133-138.

Tandon, A., Kaur, P., Mäntymäki, M., & Dhir, A. (2021): ***Blockchain applications in management: A bibliometric analysis and literature review.*** *Technological Forecasting and Social Change*, *166*, 120649.

Wang, X., Xu, Z., & Škare, M. (2020): ***A bibliometric analysis of Economic Research-Ekonomska Istraživanja (2007–2019).*** Economic research-Ekonomska istraživanja, 33(1), 865-886.

Van Eck, N., & Waltman, L. (2010): ***Software survey: VOSviewer, a computer program for bibliometric mapping***. *scientometrics*, *84*(2), 523-538.

Verma, S., & Gustafsson, A. (2020): ***Investigating the emerging COVID-19 research trends in the field of business and management: A bibliometric analysis approach.*** *Journal of business research*, *118*, 253-261.

Xu, X., Chen, X., Jia, F., Brown, S., Gong, Y., & Xu, Y. (2018): ***Supply chain finance: A systematic literature review and bibliometric analysis***. *International Journal of Production Economics*, *204*, 160-173.

A scientific paper

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PROMOTING RESPONSIBLE BUSINESS PRACTICES: THE PORTUGUESE HOSPITALITY SECTOR AS AN INNOVATION ECOSYSTEM

ABSTRACT

Responsible business practices have become a strategic imperative across industries in the face of mounting environmental challenges, shifting consumer expectations, and evolving regulatory landscapes. Due to its resource-intensive nature and close stakeholder interdependencies, the hospitality sector offers a fertile ground for implementing sustainability-driven innovations. This study explores the intersection between responsible management and sustainable innovation through a twofold approach. First, a bibliometric and thematic review of international literature (2021–2025) identifies prevailing trends, conceptual clusters, and methodological orientations in responsible business in hospitality. Second, an empirical analysis of the Portuguese hospitality ecosystem showcases how national strategies and local actors operationalize sustainability through pioneering initiatives. Three emblematic cases are examined: regional sustainability observatories, the HOSPES CSR and environmental program, and the Six Senses Douro Valley hotel. Findings reveal that Portugal's hospitality sector is an emerging innovation ecosystem where ethical governance, circular economy principles, and social value creation converge. The study contributes to a deeper understanding of how context-specific policies and practices shape responsible business models and offers implications for scholars and practitioners seeking to scale sustainable transformation in tourism.

Key words: *Responsible Business Practices; Sustainable Innovation; Hospitality Sector; Tourism Ecosystems; Circular Economy.*

1. Introduction

Responsible business practices have gained increasing prominence in recent years as a critical response to global environmental, social, and economic challenges (Odeyemi et al., 2024). Growing environmental concerns, evolving consumer expectations, regulatory demands, and reputational considerations have pressured companies to integrate sustainability into their core strategies. Simultaneously, pursuing innovation, long-term resilience, and employee engagement have reinforced the strategic value of responsible management (Alshukri, et al.,

2024). Within this context, the hospitality industry, traditionally associated with high resource consumption and strong stakeholder interdependencies, has emerged as a key sector for applying and developing sustainable and responsible business models (Martínez-Falcó et al., 2024).

Responsible business practice is a management approach informed by ethical standards, corporate social responsibility (CSR), stakeholder engagement, sustainable supply chain management, and fair labour practices (Govindan et al., 2025). These practices are intrinsically linked to the broader framework of sustainable management, which is typically conceptualized along four interdependent dimensions: environmental, social, economic, and circular. The environmental dimension involves minimizing the ecological impact of business operations through resource conservation and emissions reduction. The social dimension emphasizes human well-being, community development, and equity. Economic sustainability concerns the financial viability of business activities and their contribution to long-term prosperity. Finally, the circular economy dimension promotes closed-loop systems that reduce waste and encourage the reuse and recycling of materials. The intersection of these dimensions illustrates that responsible business practices are not merely ethical imperatives but also drivers of innovation and competitive differentiation (Lin, 2024). In the hospitality sector, in particular, integrating sustainability-oriented practices has proven instrumental in addressing ecological pressures while enhancing brand value and meeting the expectations of increasingly eco-conscious travellers. These dynamics are especially relevant in countries where tourism is pivotal in national development strategies (Chakraborty et al., 2024). Portugal offers a compelling context in this regard. Its hospitality sector has demonstrated a growing commitment to sustainability, with hotels and related enterprises actively investing in responsible practices that respond to global imperatives and local socio-economic realities (Diogo, 2024). Despite these efforts, the academic literature remains relatively limited in capturing how such practices unfold within the Portuguese context and how they contribute to the broader innovation ecosystem of the sector (Giorgi, 2024).

To address this gap, the present study adopts a twofold approach. First, it undertakes a bibliometric and thematic review of the international literature to identify dominant research trends, conceptual frameworks, and methodological orientations concerning responsible business practices in the hospitality sector. These issues are presented and discussed in section 2. An empirical case study follows this focused on the Portuguese hospitality industry, in section 3, aiming to explore how responsible and sustainable practices are operationalized in practice and how these contribute to environmental stewardship, social impact, and business performance. Finally, the article concludes with final considerations, limitations of the study, and suggestions for future work.

2. Literature Review

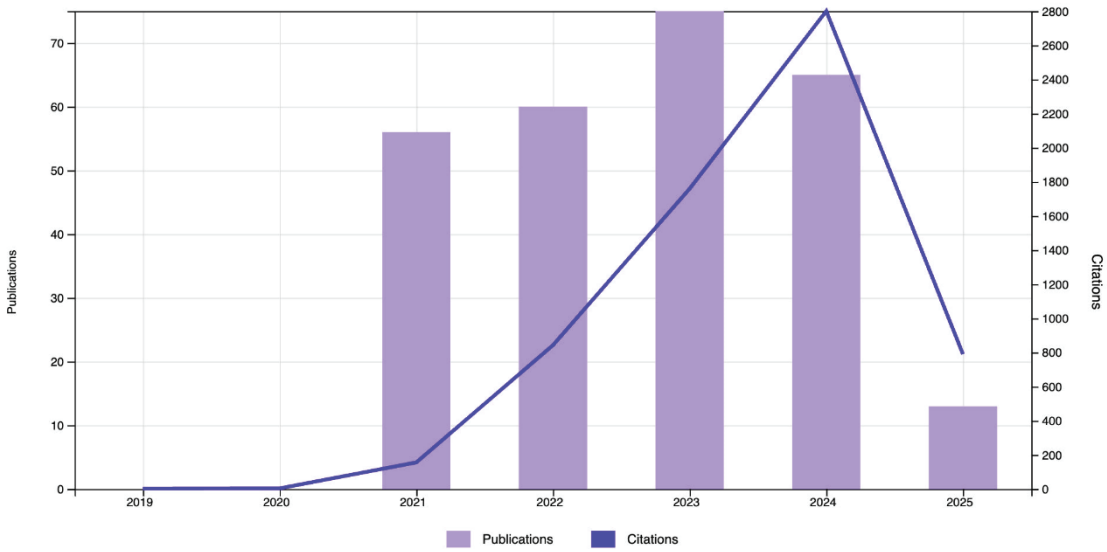
2.1. Number of publications and evolution over time

For the final assessment, 269 studies were gathered, comprising 269 Review Articles (RA) covering 2021 to 2025.

Figure 1 illustrates the progression of research publications on "BUSINESS PRACTICE*" AND "HOSPITALITY" within the Web of Science database. The earliest English-language journal and RA dates to 2021 (Tavares et al., 2021), and since then, the volume of publications has consistently increased. The most published articles were published in 2023 and 2024, with 69 and 70 documents, respectively. As for citations, 2023 registered a record number of 2,801

citations. Between 12021 and 2025, the total cited documents are 269 articles, with 6,356 citations and an H index of 45.

Figure 1: Number of publications and citations in WoS over the years



Source: Authors

2.2. Research Productivity and Co-Authorship Networks

This study identified 248 publications authored by 843 researchers affiliated with 519 institutions from 78 countries. Despite the many contributors, only five authors published more than three articles. Satish Kumar stands out as the most cited author, with 525 citations, followed by Marcello Mariani (161), Alfredo De Massis (153), Patrick Velte (132), and Marello M. Mariani (121). While prolific authorship is limited, several researchers have achieved considerable scholarly impact.

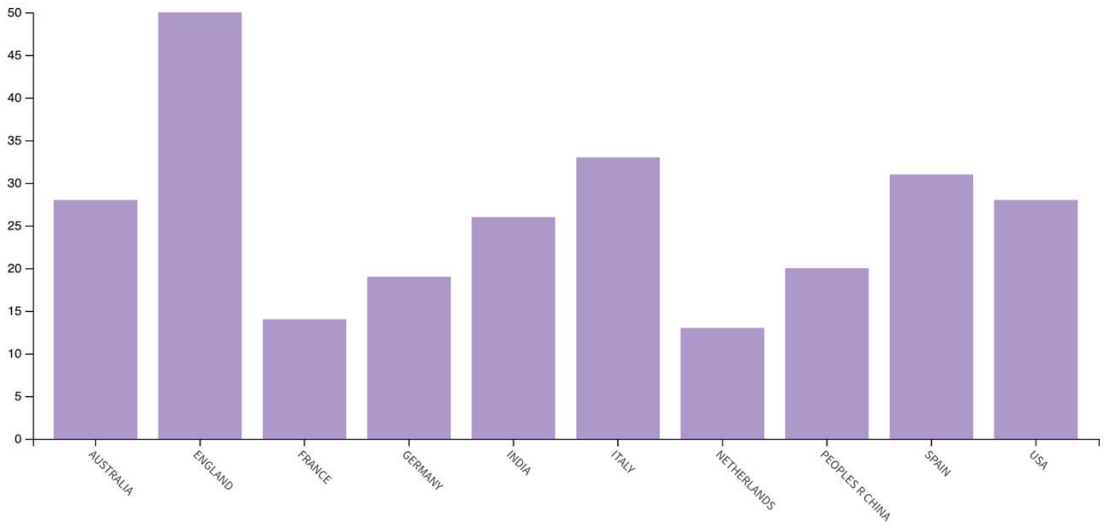
Regarding institutional productivity, only eight institutions have published more than five documents. The University of Reading and Hong Kong Polytechnic University lead in output, each contributing six publications. Institutions such as the University of Bologna, Griffith University, and Erasmus University followed closely with five documents each. Regarding citation impact, Hong Kong Polytechnic University is notable for accumulating 312 citations, followed by Griffith University with 298 and the University of Reading with 289, indicating a high research influence relative to their publication volume.

The analysis of institutional collaboration, based on the "Total Link Strength" metric, reveals that the University of Bologna and the University of Reading exhibit the highest levels of co-authorship with other organizations (link strength = 5). In contrast, Griffith University and Hong Kong Polytechnic University display limited collaboration (link strength = 1). Several institutions—including Erasmus University, Leuphana University Lüneburg, the University of Portsmouth, and the University of Valencia—recorded no collaborative ties, indicating that their research may have been conducted independently or with partners not captured within this dataset. In summary, the University of Reading emerges as highly productive and well-connected. Hong Kong Polytechnic University, although leading in citations, shows lower integration within the co-authorship network.

Researchers from 26 countries have contributed more than six articles regarding geographical distribution. The United Kingdom ranks first with 50 publications and 2,984 citations, followed by Australia (28 publications, 1,717 citations) and the United States (28 publications, 1,371

citations). Portugal appears in the 18th position, contributing 12 publications and 725 citations, reflecting a moderate but impactful presence. When analyzed by region (Figure 2), the United States leads with 47 publications, followed by India with 38 and South Africa with 21. Portugal appears in eighth position, with seven articles reaffirming its emerging role.

Figure 2: Documents by country or territory



Source: Authors

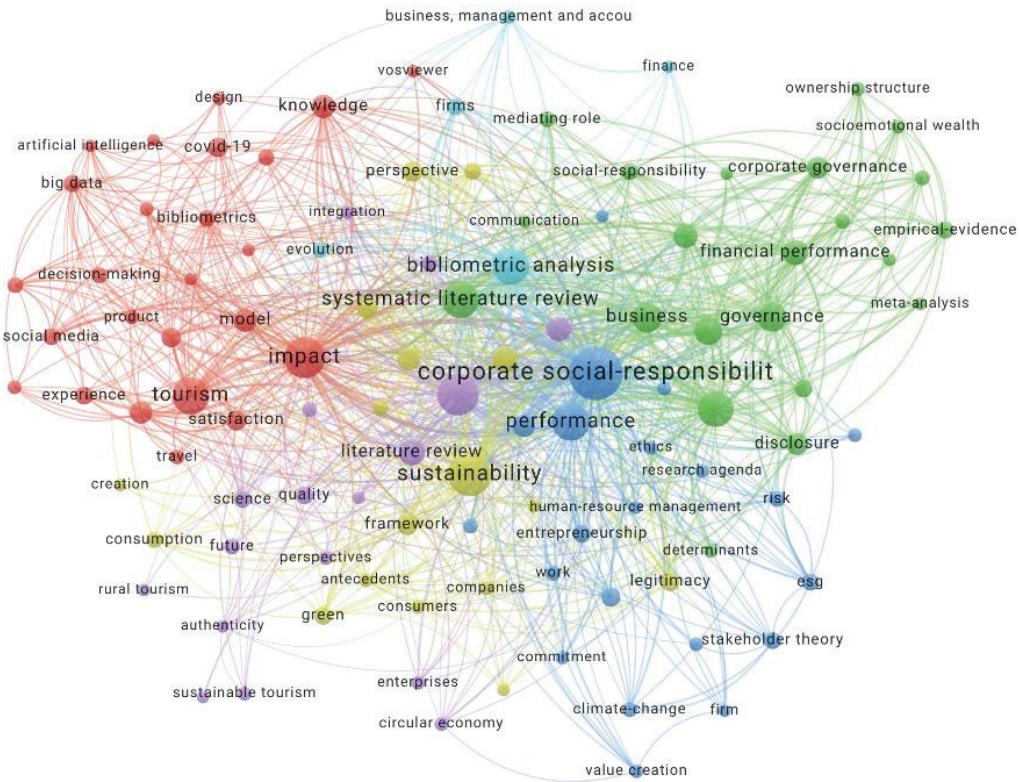
2.3. Keyword Co-Occurrence and Thematic Clusters

A keyword co-occurrence analysis was conducted based on the dataset's 1,800 unique keywords to identify key research trends and thematic orientations. Applying a minimum threshold of five occurrences, 107 keywords were retained for network visualization using VOSviewer (Figure 3). The co-occurrence network reveals six major thematic clusters, each representing a distinct yet interrelated research focus. These clusters are represented in Figure 3 and are linked with digital transformation, corporate governance and financial performance, environmental, social, and governance (ESG) frameworks, corporate social responsibility (CSR), sustainability, and performance. They are also linked with an operational dimension of sustainability and broader institutional theories in tourism, as well as sustainable tourism and rural development. Clusters are gathered as follows:

- Cluster 1 centres on digital transformation in tourism, encompassing keywords such as artificial intelligence, big data, social media, and COVID-19. This cluster reflects the increasing role of digital technologies in shaping tourism experiences, marketing strategies, and decision-making processes. COVID-19 highlights the sector's adaptive response to crises through innovation and digital engagement.
- Cluster 2 focuses on corporate governance and financial performance. It is characterized by ownership structure, empirical evidence, governance, and meta-analysis. Research in this area typically explores the influence of governance mechanisms on firm performance, often using quantitative approaches to assess causal relationships.
- Cluster 3 relates to environmental, social, and governance (ESG) frameworks and broader institutional theories. Concepts like stakeholder theory, legitimacy, and value creation dominate this space, emphasizing the theoretical foundations underpinning responsible business practices and the evaluation of their societal impacts.

- Cluster 4, situated at the network's core, highlights the centrality of corporate social responsibility (CSR), sustainability, and performance. This cluster serves as a conceptual bridge, connecting multiple research domains. Its prominence reflects the interdisciplinary nature of CSR, often studied in conjunction with sustainability metrics and organizational outcomes. The frequent co-occurrence of terms like systematic literature review and bibliometric analysis suggests that scholars are actively consolidating and synthesizing knowledge in this area, pointing to a mature and theoretically grounded field.

Figure 3: Co-occurrence of keywords analysis



Source: Authors

- Cluster 5 emphasizes the operational dimension of sustainability through concepts such as circular economy, entrepreneurship, consumers, and green innovation. This cluster indicates a shift from normative to practical approaches, examining how sustainability is embedded in business models, market behaviour, and innovation strategies. Keywords such as framework and enterprises suggest a strong orientation toward applied research and policy relevance.
- Cluster 6 explores sustainable tourism and rural development, with recurring keywords including authenticity, experience, rural tourism, and quality. This thematic area investigates how sustainability principles are implemented in tourism settings, particularly within rural or culturally sensitive environments. It also reflects the sector's growing concern with ethical consumption, cultural preservation, and the long-term viability of tourism destinations.

Together, these clusters illustrate the multidimensional and interdisciplinary nature of sustainability-oriented research in hospitality, revealing how theoretical, operational, and contextual elements converge to shape current academic discourse and future research directions. While keyword co-occurrence analysis offers valuable insight into the structure and focus of scholarly output based on predefined terms, it is equally important to explore how meaning is constructed within the broader narrative of the literature.
To deepen this understanding, the next phase of the analysis applies a text-mining approach to titles and abstracts, enabling the identification of emergent concepts and their semantic relationships. This method, presented in section 3.4, allows for a more nuanced exploration of researchers' language and provides a complementary perspective on the field's conceptual architecture.

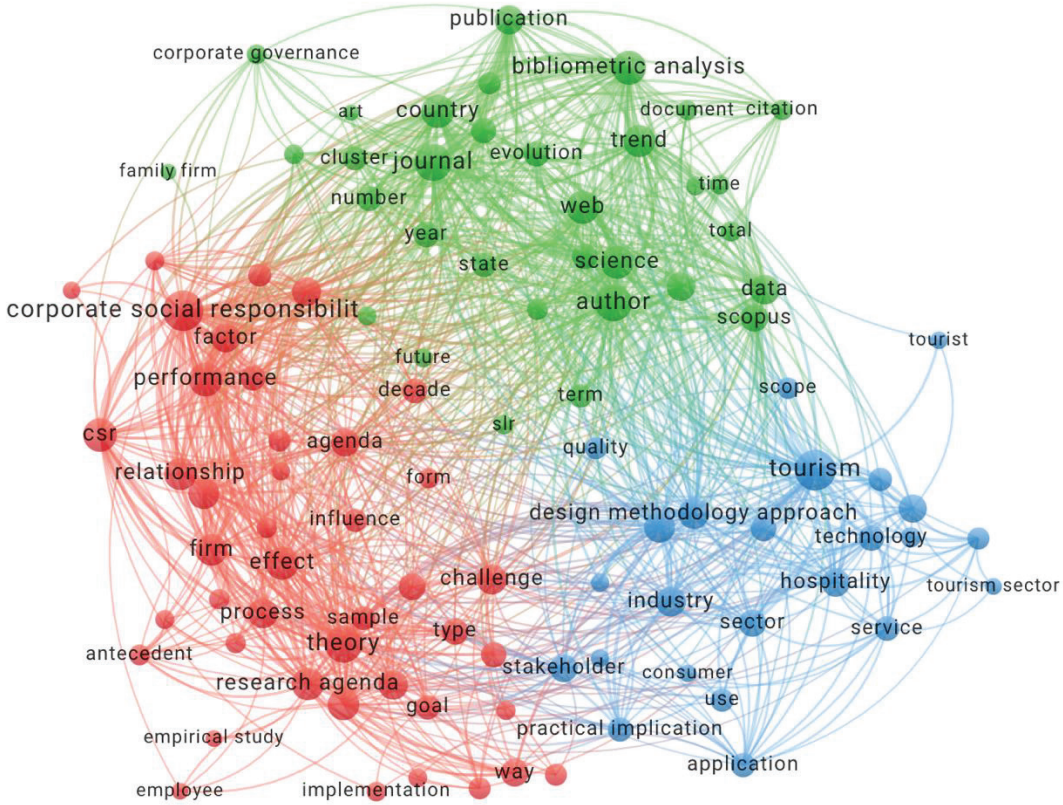
2.4. Text-Based Mapping and Term Extraction

To complement traditional bibliometric analyses, a text-based term mapping was conducted using VOSviewer's text mining functionality, which extracts and visualizes frequently occurring terms from titles and abstracts. This method offers a semantic perspective on the dataset by identifying dominant concepts and their co-occurrence patterns, thus revealing how knowledge is linguistically structured within the field. The resulting map (Figure 4) shows three primary term clusters, each associated with a distinct area of discourse, namely:

- The red cluster strongly focuses on corporate social responsibility (CSR), performance outcomes, and theoretical development. Terms such as CSR, performance, relationship, effect, theory, research agenda, and implementation emphasize understanding and explaining the mechanisms through which CSR affects organizational processes and outcomes. This cluster also includes words like antecedent, influence, and process, pointing to an interest in causal relationships and empirical validation.
- The green cluster is centred around bibliometric and scientometric analysis, encompassing terms like bibliometric analysis, publication, citation, Scopus, author, journal, and trend. This cluster represents the methodological core of the dataset, indicating that a significant portion of the literature is devoted to reviewing, mapping, and analyzing the structure and evolution of the research itself. Terms such as cluster, number, state, and decade reinforce the temporal and structural dimensions often explored in this type of work.
- The blue cluster focuses on tourism research, particularly about methodological approaches and sectoral applications. Central terms include tourism, tourist, hospitality, sector, technology, approach, design, industry, and service. This suggests a strong orientation toward applied research, exploring how tourism as a field incorporates sustainability and innovation, often through empirical and practice-based methodologies. The presence of terms like stakeholder, application, and practical implication also signals a concern with real-world relevance and knowledge transfer.

This text-based map provides a semantic layer of insight that complements the co-authorship and keyword co-occurrence analyses. It helps illuminate the language of research, which means how scholars frame their investigations and the conceptual vocabulary that structures the discourse. The spatial proximity between clusters further highlights thematic intersections: for example, the overlap between CSR theory (red) and tourism application (blue) suggests a growing interest in socially responsible practices within the tourism industry.

Figure 4: Text-based term co-occurrence map generated from titles and abstracts



Source: Authors

3. Operationalising Responsible Business Practices in Portugal: Case Insights from a Transformative Hospitality Ecosystem

In recent years, tourism has increasingly asserted itself as a strategic driver of Portugal's economic, social, and environmental development. National policy frameworks, most notably the Tourism Strategy 2027 and the forthcoming Tourism Strategy 2035 have positioned the country as a benchmark for sustainability, competitiveness, and territorial cohesion. Central to these efforts is the integration of sustainability into tourism governance, with initiatives aimed at measuring environmental impacts, fostering inclusive growth, and promoting responsible tourism across all regions. Emphasis has also been placed on developing lesser-known destinations and encouraging a more equitable distribution of tourism benefits.

The following section presents three emblematic cases that illustrate how responsible business practices are being translated into action. These cases represent distinct yet complementary dimensions of Portugal's innovation ecosystem in hospitality: territorial monitoring (regional sustainability observatories), sectoral coordination (the HOSPES programme), and private sector excellence (Six Senses Douro Valley). Each reflects a concrete and context-sensitive approach to implementing sustainability principles within the hospitality domain. These cases are the result of academic studies carried out by the authors in a collaborative and interdisciplinary way, as part of the planning of teaching resources for the curricular units they teach in Bachelor's and Master's programmes in the academic year 2024/2025.

3.1. Regional Sustainability Observatories

The strategic vision outlined in the Tourism Strategy 2027 establishes Portugal as a global reference in competitive and sustainable tourism. One of the cornerstone initiatives supporting this vision is the development of regional sustainability observatories designed to provide systematic and localized assessments of tourism's impacts. These observatories aim to enhance destination planning and governance by generating evidence-based insights, ultimately strengthening Portugal's position as an international leader in sustainable tourism.

The observatories are coordinated by Turismo de Portugal and align with the guidelines established by the World Tourism Organization (UNWTO), particularly the "Indicators of Sustainable Development for Tourism Destinations." They serve as territorial intelligence platforms, supporting responsible tourism policies adapted to regional specificities.

Portugal's commitment to this monitoring approach is evidenced by the recognition of three observatories within the UNWTO's International Network of Sustainable Tourism Observatories (INSTO). The first, the Alentejo Sustainable Tourism Observatory (ASTO), gained recognition in January 2018. This was followed in January 2020 by the Azores Tourism Observatory and the Algarve Regional Observatory for Sustainable Tourism (AlgSTO). With these initiatives, Portugal has consolidated a national framework for tracking sustainable tourism performance across diverse geographies.

In their initial phases, these observatories focused on eleven thematic domains central to sustainability assessment: (i) economic benefits; (ii) seasonality; (iii) employment; (iv) resident satisfaction; (v) energy management; (vi) water use; (vii) waste management; (viii) wastewater treatment; (ix) governance structures; (x) accessibility; and (xi) climate action. This multidimensional approach recognizes the complexity and interdependence of sustainability challenges in tourism and the need for adaptive, regionally attuned responses.

By embedding sustainability monitoring within regional planning systems, these observatories contribute to evidence-based policy and building a culture of responsibility and innovation among public and private stakeholders alike.

3.2. HOSPES Program: The Associação Hotelaria Portuguesa's Corporate Social Responsibility and Environmental Sustainability Program

The HOSPES Programme, developed in 2013 by the Hotel Association of Portugal (AHP) in collaboration with its member establishments, represents a pioneering initiative to integrate social responsibility and environmental sustainability within the national hospitality sector. Built upon the principles of a shared and circular economy, the programme aligns corporate efforts around a common objective: enhancing the sustainability of tourism operations in Portugal through coordinated and measurable action.

The programme is structured around three strategic vectors—social, economic, and environmental—and is operationalized through two core components. The first, titled "We Share", is a social responsibility initiative that facilitates the reintegration of high-quality, second-hand hotel goods into the social economy. This includes furniture, clothing, household appliances, and industrial equipment, all of which are redistributed to institutions in need. The initiative also promotes inclusive employment practices and encourages corporate volunteering, thus extending its impact beyond material donations to long-term community support.

The second component, "We Care", focuses on environmental sustainability. Grounded in reuse, reduction, and recycling principles, it encourages hotels to adopt responsible waste management practices. Participating hotels have reported significant reductions in waste sent to landfills by implementing circular systems and fostering environmental awareness among employees and guests alike.

Recognition and visibility are key elements of the programme's incentive model. Hotels demonstrating active and sustained participation receive two seals of excellence—' We Share' for social impact and 'We Care' for environmental commitment—awarded annually. These certifications serve as both reputational assets and internal benchmarks for continuous improvement.

The HOSPES Programme has received national and international acclaim, winning the European Enterprise Promotion Awards (EEPA) in 2020 under Responsible and Inclusive Entrepreneurship. It has since been showcased at multiple conferences and industry events as a model of good practice, illustrating how the hospitality sector can play a transformative role in advancing sustainability objectives.

HOSPES is a compelling example of how sector-wide responsibility can generate shared value for businesses, communities, and ecosystems by promoting collective action, fostering inclusion, and implementing tangible solutions to environmental challenges.

3.3. Hotel Six Senses Douro Valley

The Six Senses Douro Valley, part of the renowned Six Senses Hotels, Resorts & Spas brand, exemplifies a hospitality model where environmental responsibility, cultural heritage, and personal well-being are seamlessly integrated. Since its foundation in 1995, the Six Senses group has consistently embraced a sustainability-driven philosophy, positioning it as a global reference for environmentally conscious luxury tourism. With operations in over 20 countries and ambitious expansion plans, the brand's mission remains to deliver experiences promoting holistic well-being and sustainable engagement with local communities.

The Douro Valley property, established in Portugal in 2015, is housed in a meticulously restored 19th-century manor surrounded by terraced vineyards and native forests. The location embodies the brand's core values—local sensitivity, global awareness, and cultural preservation—serving as a gateway to the region's natural and human heritage. The architectural and operational choices reflect a strong commitment to environmental stewardship, cultural authenticity, and guest-centered wellness.

Six Senses Douro Valley operates under six guiding principles:

(i) Local sensitivity and global awareness, respecting regional traditions while maintaining a global vision; (ii) Responsibility and protection, fostering local partnerships and safeguarding cultural and ecological resources; (iii) Tailored experiences designed to energize, inspire, and connect guests with the surrounding environment; (iv) Wellness innovation, combining advanced technology with specialized expertise to promote holistic health; (v) Emotional hospitality, grounded in empathy and personalization; and (vi) Playfulness and curiosity, encouraging guests to rediscover joy through meaningful and unexpected experiences.

A central feature of the hotel's sustainability efforts is the Earth Lab, a dedicated environmental education and community engagement space. The Earth Lab showcases the hotel's sustainability actions and hosts interactive workshops on organic gardening, food preservation, and low-energy culinary techniques. For instance, guests learn to make yoghurt without electricity or prepare herbal infusions from dehydrated plants, fostering awareness of low-impact practices and healthy living.

The hotel also maintains on-site organic gardens, which supply its restaurants with fresh, local produce. Advanced equipment facilitates organic waste composting, reinforcing a closed-loop system and reducing the environmental footprint of operations. Furthermore, 50% of the revenue from in-house bottled water is donated to Bagos D'Ouro, a regional nonprofit organization supporting educational opportunities for underprivileged youth in the Douro region.

Recognizing its exemplary sustainability practices, Six Senses Douro Valley became the first hotel in the Iberian Peninsula to be certified by the Global Sustainable Tourism Council (GSTC). This distinction underscores the hotel's role as both an innovator in sustainable luxury and a catalyst for regional development.
By fusing luxury hospitality with deep environmental and social commitment, Six Senses, Douro Valley serves as a regenerative tourism model that minimizes harm and actively contributes to the well-being of people and the planet.

4. Analysis and Discussion of Results

The three case studies, the HOSPES Programme and Six Senses Douro Valley examined and designed regional sustainability observatories. They reveal a multidimensional ecosystem of responsible innovation in Portugal's hospitality sector and illustrate how responsible business practices are operationalized through place-based strategies, sectoral coordination, and enterprise-level innovation.

4.1. Convergence with International Trends

The Portuguese initiatives align closely with global research trends identified in the literature review, particularly those related to corporate social responsibility (CSR), ESG integration, and circular economy strategies (Dieguez, 2020; Lin, 2024; Martínez-Falcó et al., 2024). Each case reflects an embedded commitment to the four pillars of sustainable management—environmental, social, economic, and circular—outlined by Govindan et al. (2025).
For instance, the regional observatories demonstrate the practical application of ESG indicators for destination governance, reinforcing the value of data-driven decision-making and regional inclusivity in sustainable tourism planning. This supports the academic discourse on the importance of institutional frameworks and stakeholder engagement (Narula et al., 2025; Chakraborty et al., 2024).
The HOSPES Programme, in turn, illustrates the evolution of CSR from philanthropic practices to structured systems that integrate environmental and social outcomes into business models. This reflects the growing attention in the literature to hybrid value creation and shared economy approaches (Alshukri et al., 2024).
Finally, Six Senses Douro Valley exemplifies the operational dimension of sustainability, particularly in terms of customer engagement, wellness innovation, and local circular supply chains. The GSTC's recognition further validates the alignment between private initiatives and international sustainability standards.

4.2. Innovation Ecosystem Perspective

Viewed collectively, these cases suggest that Portugal's hospitality sector functions as a distributed innovation ecosystem where diverse actors (public institutions, industry associations, and private companies) collaborate or act in parallel to generate systemic impact. This aligns with emerging theoretical frameworks that conceptualize tourism destinations as living laboratories for sustainable experimentation (Mariani & Baggio, 2022; Diogo, 2024).
The interplay between macro-strategic policies (e.g., Tourism Strategy 2027), meso-level coordination (e.g., AHP and HOSPES), and micro-level initiatives (e.g., Six Senses) creates favourable conditions for scalability, policy learning, and reputational reinforcement. This ecosystemic perspective may offer valuable insights for other regions seeking to develop coherent and territorially anchored responsible tourism models.

4.3. Critical Reflections and Gaps

Despite the strengths observed, some challenges persist. The fragmentation of data limited inter-observatory integration, and modest academic engagement with these practices suggest a need for greater coordination and scholarly attention. Moreover, the scaling of private best practices, such as those of Six Senses, remains dependent on brand identity and resource availability—factors not easily replicable across the sector.

These findings resonate with limitations identified in the literature, particularly concerning translating normative sustainability goals into consistent operational frameworks (Khizar et al., 2023; Odeyemi et al., 2024). They also highlight the importance of investing in cross-sectoral collaboration, capacity building, and incentives to mainstream responsible business conduct.

5. Conclusion

This study explored how responsible business practices are operationalized in the Portuguese hospitality sector, framing it as an emerging innovation ecosystem that integrates sustainability across multiple dimensions. Drawing on a bibliometric and thematic review of recent international literature and an in-depth empirical analysis of three emblematic cases, the research highlighted the strategic and operational relevance of ethics-driven management, environmental stewardship, and inclusive value creation.

The findings reveal that Portugal's approach to sustainable hospitality is neither fragmented nor isolated; instead, it is characterized by multi-scalar governance, institutional engagement, and entrepreneurial leadership. The synergy between national policy (e.g., the Tourism Strategy 2027), sectoral frameworks (e.g., HOSPES Programme), and pioneering enterprises (e.g., Six Senses Douro Valley) illustrates a coherent and context-sensitive pathway toward sustainable transformation in tourism.

The study contributes to the literature by offering a situated analysis of responsible innovation in a real-world ecosystem. It affirms that responsible business practices are not merely reactive measures but can be structured as proactive, strategic drivers of competitiveness, territorial cohesion, and global relevance.

5.1. Limitations of the Study

Despite its contributions, the study is not without limitations. Firstly, the empirical component is based on a qualitative case analysis of selected initiatives, which, while illustrative, may not capture the full heterogeneity of the Portuguese hospitality landscape. Secondly, the reliance on secondary data sources for the bibliometric review, albeit robust, may exclude emerging contributions not yet indexed in major databases. Finally, the absence of direct stakeholder interviews limits the depth of insight into internal motivations, operational challenges, and lived experiences associated with the initiatives studied.

5.2. Future Research Directions

Future research could address these limitations by adopting mixed-methods approaches, including interviews and field observations with key hospitality and tourism governance stakeholders. Comparative studies involving other European or Mediterranean countries would also enrich the theoretical generalisability of the findings. Furthermore, applying longitudinal methodologies could help track the evolution of responsible business practices over time and their impact on organizational resilience, innovation capacity, and destination reputation.

Additionally, there is scope to explore the role of digital transformation, artificial intelligence, and data analytics in enhancing the monitoring, communication, and personalization of sustainability practices within the hospitality sector, trends already emerging in recent literature (Mariani & Borghi, 2021; Boccali et al., 2022).

5.3. Practical Implications

For policymakers, the study underscores the importance of integrated governance frameworks that align national strategies with regional and local implementation tools, such as sustainability observatories. Tourism authorities may benefit from expanding data-sharing mechanisms, investing in capacity building, and incentivizing participation through certification schemes.
For hospitality managers, the cases analyzed offer actionable insights into how circular economy models, CSR programmes, and guest engagement strategies can be harmonized to enhance both environmental performance and brand value. Industry associations like AHP play a vital role as intermediaries, offering structure, visibility, and collective legitimacy to sustainability efforts.
For academia, the article contributes to ongoing debates around innovation ecosystems, ESG integration, and the operationalization of sustainability in service sectors, particularly through context-specific, empirically grounded perspectives.

REFERENCES

Alshukri, T., Seun Ojekemi, O., Öz, T., & Alzubi, A. (2024): ***The interplay of corporate social responsibility, innovation capability, organizational learning, and sustainable value creation: does stakeholder engagement matter?.*** *Sustainability*, *16*(13), 5511.

Boccali, F., Mariani, M. M., Visani, F., & Mora-Cruz, A. (2022): ***Innovative value-based price assessment in data-rich environments: Leveraging online review analytics through Data Envelopment Analysis to empower managers and entrepreneurs***. *Technological Forecasting and Social Change*, *182*, 121807.

Chakraborty, D., Polisetty, A., Nunkoo, R., & Rana, N. P. (2024): ***What drives tourists towards sustainable behaviour? A longitudinal study***. *Asia Pacific Journal of Tourism Research*, *29*(3), 352-374.

Dieguez, T. (2020): ***Operationalization of circular economy: a conceptual model***. In *Handbook of Research on Entrepreneurship Development and Opportunities in Circular Economy* (pp. 38-60). IGI Global.

Diogo, J. C. B. (2024): ***Sustainability in Portuguese Hotels: Is the Circular Economy Coming to the Hospitality Sector?*** (Master's thesis, Universidade Catolica Portuguesa (Portugal)).

Giorgi, L. (2024): ***Scenarios for the future of nature tourism in Portugal–time horizon: 10 years Traditional Tranquility*** (Master's thesis, Universidade NOVA de Lisboa (Portugal)).

Govindan, K., Kaliyan, M., Kannan, D., & Haq, A. N. (2025): ***Social Sustainability.*** *Sustainable Supply Chain Management*, *17*(8), 455-466.

Khizar, H. M. U., Younas, A., Kumar, S., Akbar, A., & Poulova, P. (2023): ***The progression of sustainable development goals in tourism: A systematic literature review of past achievements and future promises***. *Journal of Innovation & Knowledge*, *8*(4), 100442.

Kraus, S., Breier, M., Lim, W. M., Dabić, M., Kumar, S., Kanbach, D., ... & Ferreira, J. J. (2022): ***Literature reviews as independent studies: guidelines for academic practice***. *Review of managerial science*, *16*(8), 2577-2595.

Lin, W. L. (2024): ***The role of corporate social responsibility and corporate social irresponsibility in shaping corporate reputation: An analysis of competitive action and innovation strategies***. *Corporate Social Responsibility and Environmental Management*, *31*(2), 1451-1468.

Mariani, M. M., Al-Sultan, K., & De Massis, A. (2023): ***Corporate social responsibility in family firms: A systematic literature review***. *Journal of Small Business Management*, *61*(3), 1192-1246.

Mariani, M., & Baggio, R. (2022): ***Big data and analytics in hospitality and tourism: a systematic literature review***. *International Journal of Contemporary Hospitality Management*, *34*(1), 231-278.

Mariani, M., & Borghi, M. (2021): ***Are environmental-related online reviews more helpful? A big data analytics approach***. *International Journal of Contemporary Hospitality Management*, *33*(6), 2065-2090.

Mariani, M. M., Borghi, M., & Laker, B. (2023): ***Do submission devices influence online review ratings differently across different types of platforms? A big data analysis***. *Technological Forecasting and Social Change*, *189*, 122296.

Martínez-Falcó, J., Marco-Lajara, B., Zaragoza-Sáez, P., Seva-Larrosa, P., & Ruiz-Fernández, L. (2024): ***Sustainable intellectual capital as a roadmap to sustainability: a systematic literature review.*** *International Journal of Business Environment*, *15*(2), 193-219.

Miroshnychenko, I., De Massis, A., Barontini, R., & Testa, F. (2022): ***Family firms and environmental performance: A meta-analytic review***. *Family Business Review*, *35*(1), 68-90.

Narula, R., Rao, P., Kumar, S., & Paltrinieri, A. (2025): ***ESG investing & firm performance: Retrospections of past & reflections of future.*** *Corporate Social Responsibility and Environmental Management*, *32*(1), 1096-1121.

Odeyemi, O., Usman, F. O., Mhlongo, N. Z., Elufioye, O. A., & Ike, C. U. (2024): ***Sustainable entrepreneurship: A review of green business practices and environmental impact.*** *World Journal of Advanced Research and Reviews*, *21*(2), 346-358.

Oduro, S., Umar, R. M., De Massis, A., & Haylemariam, L. G. (2024): ***Corporate social responsibility and family firm performance: A meta-analytic review***. *Corporate Social Responsibility and Environmental Management*.

Pandey, N., Andres, C., & Kumar, S. (2023): ***Mapping the corporate governance scholarship: Current state and future directions***. *Corporate Governance: An International Review*, *31*(1), 127-160.

Prayag, G., Chowdhury, M., Prajogo, D., Mariani, M., & Guizzardi, A. (2022): ***Residents' perceptions of environmental certification, environmental impacts and support for the world expo 2015: The moderating effect of place attachment.*** *International Journal of Contemporary Hospitality Management*, *34*(3), 1204-1224.

Tavares, M. S. D. A., Gohr, C. F., Morioka, S., & da Cunha, T. R. (2021): ***Systematic literature review on innovation capabilities in clusters***. *Innovation & Management Review*, *18*(2), 192-220.

Velte, P. (2022): ***Archival research on integrated reporting: a systematic review of main drivers and the impact of integrated reporting on firm value***. *Journal of Management and Governance*, *26*(3), 997-1061.

Velte, P. (2023): ***Determinants and consequences of corporate social responsibility decoupling—Status quo and limitations of recent empirical quantitative research***. Corporate Social Responsibility and Environmental Management, 30(6), 2695-2717.

Velte, P. (2023): ***Which institutional investors drive corporate sustainability? A systematic literature review.*** *Business Strategy and the Environment*, *32*(1), 42-71.

Velte, P. (2024): ***Corporate social responsibility (CSR) and earnings management: A structured literature review with a focus on contextual factors***. *Corporate Social Responsibility and Environmental Management*, *31*(6), 6000-6018.

Web references:
Tourism Strategy 2027 (ET2027)
TravelBI by Turismo de Portugal - Regional Sustainability Observatories
Programa HOSPES by Associação da Hotelaria de Portugal
Douro Valley Hotel and Spa in Portugal | Six Senses

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FROM THEORY TO PRACTICE: A BIBLIOMETRIC AND SYSTEMATIC REVIEW OF STAKEHOLDER MANAGEMENT IN SOCIAL ECONOMY PROJECTS

ABSTRACT

Stakeholder management plays a crucial role in the success of projects, particularly in the Social Economy sector, where a wide variety of stakeholders with diverse interests must be effectively engaged. Despite the recognized benefits associated with the implementation of practices in this domain, there remains a scarcity of studies examining stakeholder management in socially oriented projects. This study aims to fill this gap by conducting a systematic literature review and bibliometric analysis. The objective is to identify key research trends, influential works, and potential gaps in the literature. To achieve this, we conducted a comprehensive literature review, examining theoretical frameworks and best practices in stakeholder management, with a focus on their application in social projects. Additionally, a bibliometric analysis was performed, considering 122 articles to assess scientific production over the past decade, providing a quantitative overview of the field's evolution. A search was conducted in the Web of Science database, covering topics such as Stakeholder Management, Social Enterprises, and Agile, along with related concepts to ensure broader coverage. The results were refined through a two-stage filtering process, and the analysis was conducted using R and the Bibliometrix package. The study highlights the methodologies predominantly implemented in stakeholder management, compares traditional and agile approaches from a project management perspective, and identifies areas that require further research. The exploration of these methodologies aims to understand the benefits and drawbacks associated with each, to refine the tools and techniques that best suit stakeholder management in social economy projects. By combining both quantitative and qualitative approaches, this research aims to contribute to the advancement of knowledge, guide future research, and support effective stakeholder management practices in the social economy context.

Key words: *Stakeholder Management; Social Enterprises; Methodologies; Assessment tools.*

1. Introduction

Humanity is currently facing significant social, economic and environmental challenges that affect all communities, especially the most vulnerable. In response, the United Nations Sustainable Development Goals (SDGs) offer a global framework that seeks to eradicate poverty, inequality, environmental degradation and social injustice, among other critical

issues (Fonseca et al., 2020). Aligned with these principles, the social economy is emerging as a field of research of organisations and practices whose primary goal is not profit maximisation, but to fulfilling collective needs and generating positive societal impact (Flórez et al., 2021).

In this sector, projects are increasingly recognised as intervention tools that aim to reduce vulnerabilities and address problems in different areas. In line with the different values mentioned above, the diversity and multiplicity of stakeholders is identified as a key factor for the success of social projects (Radoynovska, 2024). Despite the numerous existing studies in this field, there is still a limited approach to the tools and techniques applied to stakeholder management in social economy projects. This study aims to fill this gap in the literature by investigating the applicability of stakeholder management tools and techniques in the context of the social economy, from the perspective of stakeholder alignment.The central question guiding this research is: "What tools and techniques enable better stakeholder alignment in social project management?" The main objective outlined is to contribute to best practices in stakeholder management within social project management. To achieve this, the following specific objectives have been set:

O1. To analyse the current literature on stakeholder management in social economy projects;

O2. To analyse existing tools and techniques for stakeholder management in organisations;

O3. Investigate the applicability of these identified tools and techniques in the management of social economy projects;

The development of this work contributes to the analysis of the most appropriate tools and techniques for stakeholder management in social economy projects, proposing a practical model for stakeholder alignment. This model aims to systematise the stages of stakeholder management, adapting practices to the reality of social projects. In the future, the model could be tested and adapted, allowing further studies to explore its effectiveness in different contexts and communities.

2. Literature Review

This section provides a theoretical foundation by exploring the concepts of social economy, project management and stakeholder management. It focuses particularly on the tools and techniques used to support stakeholder alignment.

2.1. Social Economy

Social economy is a broad concept that encompasses economic practices that aim to meet human needs, promote justice and social cohesion, and are based on the principles of solidarity (Cojocaru & Sfetcu, 2013). Cace et al. (2011) state that the social economy addresses not only the social sphere, but also the economic sphere, as it seeks to provide the necessary resources and income to ensure that individuals have access to a socially acceptable standard of living. The social economy is thus described as a hybrid sector, combining market elements for the production of goods and services with state mechanisms for redistribution to promote equity. Moulaert and Aileneu (2005) argue that understanding this hybridity requires contextualising three related concepts within the social economy: the third sector and the solidarity economy.

The non-profit sector, as its name suggests, operates on the principle of not-for-profit. Since the distribution of profits may be restricted by law, any surplus must be reinvested in the activities of the organisations themselves. The third sector, on the other hand, is created by private initiatives but relies on government funding and guidelines, thus coexisting with both

the private and public sectors. The social economy includes individual, family and community initiatives, whether formal or informal, that do not aim to make a private profit. Many of these initiatives are linked to the voluntary sector and involve the active participation of individuals in unpaid initiatives for social benefit (Claudius & Barbosa, n.d.).
The social economy comprises different entities with different legal and organisational forms. Their configuration depends on the legal system and contextual characteristics of each country. Some of these entities use legal forms created specifically to support the development of the social economy. In contrast, others use more common legal structures such as associations, cooperatives, mutual societies, foundations or even conventional companies. Even if they were not originally designed for this purpose, these forms can be used to develop economic activities with general interest objectives, even if they sometimes face limitations in this framework (European Commission, 2020).
As a key driver of sustainable development, the social economy fosters innovative solutions to social challenges. By aligning with the SDGs, it reinforces the importance of a global agenda that promotes cooperation, resource sharing and coordinated efforts among nations to ensure sustainability and social justice for all.

2.2. Social Economy Projects

Social Economy is not limited to theoretical principles but operates through practical approaches that seek to translate these ideologies into tangible impacts on people's lives (Cojocaru & Sfetcu, 2013). In this context, social projects emerge as a fundamental tool that aims to implement the objectives of the social economy in line with the Sustainable Development Goals (SDGs).
The Project Management Institute (PMI) (2017) defines a project as a temporary effort undertaken to create a unique product or service that requires structured planning, execution and monitoring. Based on this definition, project management can be understood as the application of knowledge, techniques and tools across different activities to ensure project success and compliance with project requirements. According to Lohinova (2024), social projects are innovative initiatives designed to address specific social problems and promote improved quality of life and positive change for the most vulnerable groups. Like other types of projects, they are developed within a given timeframe and budget. However, social projects tend to rely more heavily on external funding, partnerships and awareness campaigns, which require a high level of transparency and ethical commitment from all involved.
Social projects are led by people and, above all, for people. One of their key characteristics is the large number of stakeholders involved in their governance, with different roles and expectations. As highlighted by Fontana (2018), their engagement plays a decisive role in project success. Given the complexity, the next section focuses on stakeholder management as a central element in social projects.

2.3. Stakeholders Management

The stakeholder theory, introduced by Freeman (1984), defines stakeholders as any group or individual who influences or is influenced by the actions of a project or organisation (Talbot et al., 2021). The theory emphasises that project outcomes are shaped by how effectively these relationships are identified and managed (Wellens & Jegers, 2014; Hansen, 2023). As such, decision-making processes should take into account the perspectives and interests of different stakeholders and seek to balance economic objectives with stakeholder expectations. Effective stakeholder management involves identifying and engaging key stakeholders in a structured way that aligns their expectations with project objectives. This process provides

valuable insights, supports informed decision-making, and fosters trust and communication — all of which contribute to greater resilience in complex contexts and improved project outcomes (Aderibigbe & Fragouli, 2020).

Hansen (2023) notes that stakeholder theory is primarily designed for profit-driven organisations. However, it can also be applied to the social economy sector, as ethical resource mobilisation requires that activities are first aligned with the organisation's mission and then considering the interests of stakeholders who may affect or be affected by its activities. The author further argues that the normative approach to stakeholder theory facilitates the alignment of stakeholder interests.

In line with this perspective Silva & Fernández (2016) define stakeholder alignment as the coordination of stakeholder interests, objectives and expectations. This alignment is essential to fostering positive interactions, improving communication and strengthening commitment throughout the project. The following section presents the tools and techniques that support stakeholder management, considering both traditional and agile project methodologies.

2.3.1. Tools and Techniques in Stakeholder Management

Effective stakeholder management and the resulting alignment of their interests requires the application of tools and techniques that facilitate the identification and assessment of stakeholders, followed by active engagement and alignment of expectations (A. P. Da Silva & Fernández, 2016). The choice of tools and techniques may vary depending on the project methodology. In this study, both traditional and agile methodologies are examined.

A project management methodology is defined as a structured set of principles and practices that are applied throughout the execution of a project. To ensure alignment with the chosen methodology, project managers use a range of techniques and tools to support task development and project execution (Sjekavica Klepo & Radujković, 2019).

2.3.2. Traditional Methodology

The traditional methodology is characterised by a structured and linear approach to project management. Its processes follow a well-defined, sequential order that requires the completion of one phase before the next can begin (Gemino et al., 2021). Traditional methodologies are based on the guidelines of the Project Management Institute (PMI), in particular the Project Management Body of Knowledge (PMBOK), which defines a set of standard project management practices.

In line with the principles of this methodology, the PMBOK framework defines four key phases of stakeholder management: identifying stakeholders, planning stakeholder management, managing stakeholder engagement and controlling stakeholder engagement. These phases structure the interaction between the project and its stakeholders, ensuring effective communication and alignment with project objectives.

Stakeholder identification takes place in the initial phase of project management and aims to recognise all groups or individuals that influence or are influenced by the development of the project (Pandi-Perumal et al., 2015). These stakeholders must be analysed and categorised based on different characteristics, in particular their relationship with the organisation, which determines whether they are internal or external stakeholders. According to (Fassin et al., 2017) internal stakeholders have a formal link with the organisation, while external stakeholders do not have a formal link but still influence or are influenced by the activities of the organisation. Stakeholders should also be classified according to their level of interest, influence, importance and expectations. To facilitate this, the PMBOK identifies several classification models, including the Power/Interest Matrix, the Power/Influence Matrix and

the Influence/Impact Matrix, which allow stakeholders to be assessed according to different variables and categorised as high or low relevance to the project. These models help to define the importance of each stakeholder and the engagement strategy. Another classification model referenced in the PMBOK is the Salience Model, which categorises stakeholders based on their power, legitimacy and urgency, ensuring that those most critical to the success of the project are prioritised. Stakeholders with high power, influence or interest require close and continuous management. Those with high power but low interest should be kept informed, while those with low power and low interest should be monitored. Meanwhile, stakeholders with low power but high interest should be kept satisfied (Pandi-Perumal et al., 2015). Stakeholder analysis is a critical and complex process that involves identifying as many relevant stakeholders as possible and understanding their needs and expectations. This initial stage is essential for subsequent stakeholder categorisation and prioritisation (Pandi-Perumal et al., 2015). The process is structured through data collection, supported by tools such as the classification matrices mentioned above, and techniques such as expert opinion, brainstorming and meetings. Expert opinion involves consulting individuals or groups with specialised knowledge in the field, providing valuable insights for stakeholder analysis. Brainstorming encourages collective brainstorming and discussion, allowing different perspectives to be explored. Meetings play a strategic role, serving as formal sessions for joint stakeholder analysis, promoting the alignment of perceptions and the development of a shared understanding of the stakeholders, significantly contributing to the effectiveness of the analysis process (Pandi-Perumal et al., 2015). Once all stakeholders have been analysed and identified, a document should be created to compile detailed information about them and facilitate the organisation and management of stakeholder-related data (Pandi-Perumal et al., 2015). This document, known as the stakeholder register, serves as the main output of this stage of stakeholder management (PMI, 2017).

Following this stage, the stakeholder management plan is developed. Based on the information gathered, tailored strategies are formulated to effectively engage stakeholders throughout the project lifecycle and ensure that their needs and expectations are met.

To plan stakeholder engagement, project managers often use tools and techniques similar to those used in the identification phase, such as expert opinions and meetings. In addition, analytical techniques are used to assess the level of engagement required for each stakeholder, taking into account their sensitivity to the project objectives (Pandi-Perumal et al., 2015). The data collected should be presented using the Stakeholder Engagement Assessment Matrix, which assesses stakeholders based on their current and desired levels of engagement. If a stakeholder's engagement does not match the desired state, the project manager should implement strategies to increase their involvement and ensure the necessary level of support and leadership for project success (Pandi-Perumal et al., 2015).

The Stakeholder Management Plan is the key deliverable of this phase. It is a document that outlines strategies and approaches for managing stakeholders throughout the project (PMI, 2017). According to Pandi-Perumal et al. (2015), this document typically includes information such as stakeholder communication needs, communication requirements, methods and frequency of communication, and who is responsible for ensuring effective communication. In addition, it should specify the required level of stakeholder involvement at different project stages, as well as management strategies to increase support and engagement while minimising potential risks that could impact the project. This document needs to be continually updated to reflect any changes to the project and to ensure that all stakeholders remain aligned with the project's objectives and developments.

Following the planning phase, the stakeholder engagement process is implemented, focusing on meeting stakeholder expectations, maintaining clear communication and addressing concerns (Pandi-Perumal et al., 2015). The project manager must ensure that stakeholder

interactions occur as planned, while proactively identifying and resolving issues or conflicts to foster positive relationships and reduce resistance (PMI, 2017). This phase uses similar tools and techniques to the previous stages, including expert opinions and meetings. However, additional skills become particularly important, such as communication and interpersonal skills. These include feedback exchange, conflict resolution, cultural and political awareness, observation skills and negotiation skills (PMI, 2017).

During this phase, any deviations identified in the project must be formally recorded and assigned to a responsible party for resolution. If necessary, change requests should be submitted, which may include changes to the project scope, corrective or preventive actions. Any new stakeholder requirements should also be documented. The key outcome of this phase is the continuous updating of all project documents, ensuring alignment between the project team and stakeholders (Pandi-Perumal et al., 2015).

Stakeholder engagement monitoring is the process of tracking, evaluating and controlling stakeholder relationships and their involvement in the project. According to the PMBOK (PMI, 2017), this requires continuous feedback from all parties, identification of project changes, and assessment of their impact on stakeholder engagement. Necessary adjustments should be made to maintain consistent stakeholder support. All changes need to be recorded in a change management plan, and project documents should be updated whenever necessary (Pandi-Perumal et al., 2015). In terms of tools and techniques, this stage relies on similar approaches to the previous stages, with particular emphasis on interpersonal and communication skills, decision-making processes and meetings. Feedback analysis plays a crucial role in identifying patterns and problem areas, while regular meetings facilitate project reviews, progress discussions and more informed decision-making (PMI, 2017).

The structured processes outlined in the PMBOK, along with the associated tools and techniques, emphasise the linear and procedural nature of stakeholder management. The emphasis on detailed documentation enhances transparency and stakeholder traceability, which is particularly beneficial in complex project environments.

2.3.3. Agile Methodology

The agile methodology differs significantly from the traditional approach, emphasising greater flexibility and collaboration. This approach is characterised by its adaptability to change, which means that the project team can quickly modify and adjust the project plan to meet the needs of stakeholders (Hobbs, 2017).

According to Dong et al. (2024), the agile methodology is based on a set of guiding principles and practices, although there is still no universally established set of tools and techniques associated with it. Among the commonly used practices, Scrum stands out as a dominant framework.

Scrum is an agile method that structures projects into short, iterative cycles, allowing a large and complex process to be broken down into smaller, more manageable parts that can be completed more efficiently. These short cycles, called sprints, typically last two weeks. The project manager is responsible for organising the various project processes into sprints (Udvaros et al., 2023). This method is based on three fundamental principles: transparency, control and adaptation. All activities within the project should be clearly understood by all stakeholders, ensuring an environment of transparency and alignment. Each project process can be regularly evaluated at any time to ensure that development is in line with the established plan. In addition, the project must be adjusted in response to obstacles or new requirements, fostering an environment of rapid adaptation and responsiveness to emerging needs and changes (Udvaros et al., 2023).

To maintain the principles of Scrum, Udvaros et al. (2023) highlight several key procedures. One is refinement, which involves analysing and filtering high-level stakeholder requirements to ensure they are both understandable and actionable. This is followed by the planning phase, where the team holds a meeting to define the work required to meet these refined requirements. The planned work is then divided into sprints, ensuring that each sprint has a balanced workload and results in a deliverable. Scrum also includes daily stand-up meetings, where project members share what they have done, outline their tasks for the current day, and identify potential barriers. After each sprint, a retrospective meeting is held to reflect on the work completed, analyse strengths and weaknesses, and draw lessons for future sprints. There is also a Sprint Review, where the work produced is presented to stakeholders, allowing them to assess progress and provide feedback. Looking at stakeholder management from an agile perspective, Silva et al. (2024) suggest that centralising stakeholder functions can improve alignment with project needs and expectations. By organising work so that fewer individuals are directly involved, the project reduces the need for multiple levels of communication, eliminating intermediaries and minimising the risk of conflict. Hobbs (2017) supports this idea, stating that in large projects, the presence of multiple stakeholders can complicate agile processes, requiring better coordination and communication to align expectations. Concentrating responsibilities within a core group promotes a more efficient flow of communication and greater alignment with project goals (A. S. Silva et al., 2024). The iterative nature of agile methodology inherently requires continuous stakeholder engagement and active participation throughout the project lifecycle (Dong et al., 2024). In addition, regular communication and ongoing feedback loops ensure consistent stakeholder alignment. Silva et al. (2024) advocate collaborative tools and frequent meetings as essential elements for maintaining effective communication, preventing conflict and facilitating timely adjustments. These feedback cycles allow work to be reviewed and corrected whenever necessary, ensuring stakeholder satisfaction and building trust throughout the project.

Although the literature does not establish a definitive set of techniques or tools for an agile approach, its practices clearly emphasise the creation of a dynamic environment that prioritises active and continuous stakeholder involvement. This engagement promotes greater alignment, transparency, flexibility and adaptability, with the ultimate aim of improving stakeholder satisfaction.

2.3.4. Traditional VS Agile in Stakeholder Management

Hobbs (2017) highlights several benefits of applying agile methods in project management, compared to the traditional approach. These include enhanced team communication and collaboration, as well more positive organisational environment where leadership is emphasised over control and authority. Agility also contributes to improved performance, particularly in terms of time efficiency and quality, which explains its growing adoption across organizations. However, the flexibility and less process-driven nature of agile methodology also presents challenges. While Gemünden (2015) points to the lack of sufficient studies to fully substantiate its drawbacks, Dong et al. (2024) identify several limitations. One of the main challenges is the difficulty of applying agile methods in large organisations, where greater interdependencies between systems and departments can lead to delays in meeting deadlines and deliverables. In highly hierarchical and rigid organisational structures, the rapid decision-making characteristic of agile approaches becomes more difficult, reducing overall flexibility. Conversely, less rigidity and authority can lead to uncertainty about roles and responsibilities, potentially affecting project alignment and performance.

In this context, Hobbs (2017) suggests that combining methodologies can be beneficial in certain scenarios, particularly when seeking to balance the flexibility and adaptability of agile approaches with the structured decision-making processes characteristic of traditional methodologies. Dong et al. (2024) support this perspective, arguing that agile methods can complement the predictability and structure of traditional methods, particularly in high-risk situations or contexts that require strict regulatory compliance. A hybrid approach can therefore be effective, depending on how practices are integrated and the specific context in which they are applied. However, the author also notes that research on this topic remains limited, highlighting the need for further study.

2.4. Stakeholder Management in Social Economy Projects

Stakeholder management is a critical process in project management that plays a crucial role in ensuring that all stakeholders are aligned - moving in the same direction to achieve project objectives. In the social economy, where a large number of stakeholders with different interests are involved, achieving this alignment becomes an even greater priority.
To better understand stakeholder management in the economy sector, this study sought to deconstruct the process. It found that stakeholder theory, traditionally associated with for-profit sectors, can be effectively applied to social economy contexts. The basic premise of this theory is that project managers need to identify, understand and manage stakeholder expectations, taking into account their influence on the project (Hansen, 2023).

As for the tools and techniques used in stakeholder management, their application varies according to the methodology adopted. The traditional methodology, characterised by a linear and process-driven approach, provides a well-defined set of tools and techniques. Frameworks such as the PMBOK establish clear guidelines for identifying, categorising and monitoring stakeholders, providing a structured framework that is particularly suited to longer-term or highly structured projects. However, this methodology may have limitations in more dynamic and flexible environments (Pandi-Perumal et al., 2015). In contrast, the agile methodology is characterised by greater adaptability, allowing for rapid adjustments throughout the project lifecycle. Agile approaches emphasise short feedback cycles and continuous stakeholder engagement, which can be particularly beneficial for projects that require a high degree of flexibility. However, precisely because of its flexible nature, there is less concrete definition in the literature of the specific tools and techniques to be used (Hobbs, 2017).
Considering the characteristics, advantages and limitations of both methodologies, it is suggested that in certain contexts a hybrid approach - combining traditional and agile methodologies - could offer significant benefits. This integration would allow for greater flexibility while providing more control and structure to project processes. However, there is limited literature on this topic, highlighting a gap in research. This provides an opportunity for future studies to explore and address key issues related to the effectiveness and application of hybrid stakeholder management approaches.

3. Research Methodology

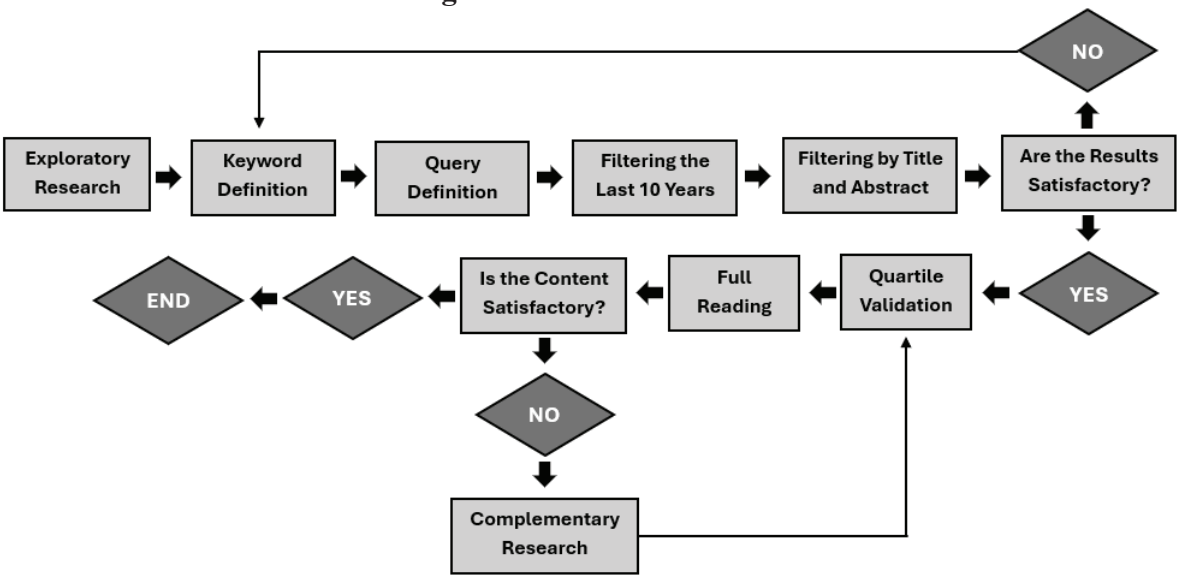
This study is characterised as exploratory, qualitative research based on an analysis of current literature. To guide the investigation and provide a structured path towards answering the main research question, the following sub-questions were formulated:

- How is the topic addressed in the current literature?
- What are the main tools and techniques identified in stakeholder management?

- How does stakeholder management differ between traditional and agile approaches?
- How is stakeholder management carried out in social economy projects?

The literature review was conducted using an integrated approach combining bibliometric analysis and complementary bibliographic research (Figure 1). This approach aimed to provide a comprehensive understanding of the topic and to deepen the insights developed in this study. The combination of bibliometric analysis and systematic literature review is a robust methodological approach often used in scientific research. Bibliometric analysis, which is quantitative in nature, allows the identification of publication patterns, collaborative networks and conceptual structures. The systematic review, in turn, provides a qualitative examination of the most relevant theoretical contributions. This integration ensures a rigorous, transparent and replicable research process, which increases the reliability of the results (Grijalva et al., 2023).

Figure 1: Research Process



Source: Authors

As a systematic and quantitative method, the bibliometric analysis was carried out using two different queries (Figure 2), reflecting the two central themes of this study: stakeholder management in social projects and stakeholder management across methodologies. An initial attempt to combine these themes into a single query proved unsatisfactory. Therefore, the two searches were conducted separately to obtain more specific and relevant data.

Given that the selection of the database directly influences the scope and quality of the collected data (Öztürk et al., 2024), the search was conducted using the Web of Science database, including the main keywords - stakeholder management, social enterprises and agile - as well as related or equivalent concepts to broaden the scope of the search. A two-step filtering process was used to refine the results. First, only articles published in the last ten years (2014-2024) were selected. This temporal delimitation aims to ensure the relevance of the data analysed and to align the review with the latest trends in the research field. As noted by Aria and Cuccurullo (2017), the definition of the time span is an important methodological decision, as it allows researchers to obtain either a current snapshot or an evolutionary view of the scientific field, which is particularly useful for identifying recent dynamics and emerging topics. Then, the titles and abstracts were carefully reviewed to ensure that only the most relevant studies were included. This step was crucial because keyword searches often retrieved articles with little or no relevance to the research topic. This problem was frequently

observed and justified the discrepancy between the initial number of results and the final data set. The bibliometric analysis was carried out using specialised software tools, including R and Bibliometrix. The results obtained through this process are further explored in the following sections.

Figure 2: Results of Article Filtering

Query	Keywords Combination	Initial Results	Application of 1st Criterion	Application of 2nd Criterion
1	TI= STAKEHOLDER AND (AB= STAKEHOLDERS ANALYSIS OR AB= STAKEHOLDERS APPROACH OR AB= STAKEHOLDERS STRATEGY OR AB= STAKEHOLDERS ENGAGEMENT OR AB= STAKEHOLDERS MANAGEMENT) AND (AB= SOCIAL ENTERPRISES OR AB= NONPROFIT ORGANIZATIONS OR AB= NGO OR AB= THIRD SECTOR OR AK= SOCIAL ECONOMY OR AK= SOCIAL PROJECT)	409	357	84
2	TI= AGILE AND (AB= STAKEHOLDERS ANALYSIS OR AB= STAKEHOLDERS APPROACH OR AB= STAKEHOLDERS STRATEGY OR AB= STAKEHOLDERS ENGAGEMENT OR AB= STAKEHOLDERS MANAGEMENT)	255	219	38

Total Results: 122

Source: Authors

4. Results and Discussion

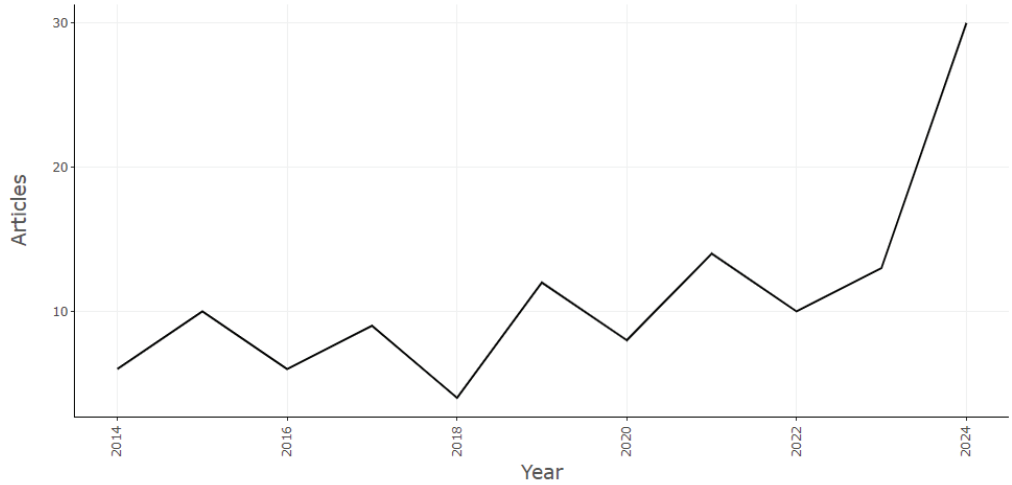
4.1. Bibliometric Analysis

An overview of the bibliometric analysis is presented in Figure 3, which summarises key indicators such as the number of documents, growth rate, authorship, and average citations per article. The bibliometric analysis revealed an annual growth rate of 17.46% in scientific production related to stakeholder management in social projects, with a significant increase after 2023, as shown in Figure 4. This growth suggests a growing interest in the topic, possibly driven by new societal demands.

Figure 3: Overview of the bibliometric analysis

Source: Bibliometrix

Figure 4: Annual scientific production

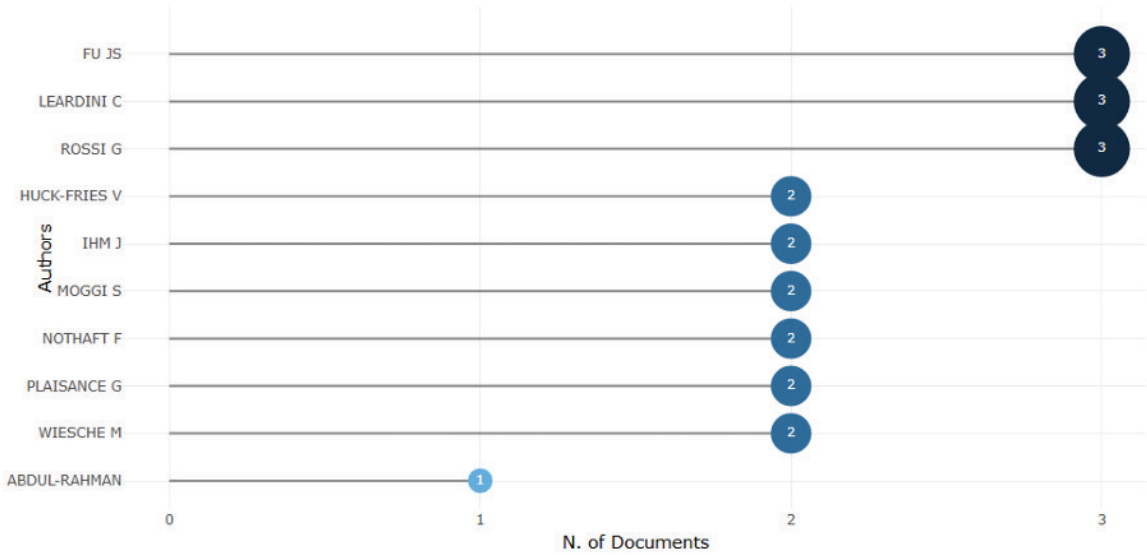


Source: Bibliometrix

A total of 358 authors contributed to the articles analysed, with an average of 3.03 co-authors per document, highlighting the collaborative and interdisciplinary nature of research in this field. The most influential authors were identified based on the number of publications and citations, with authors such as Smith, J., Brown, A. and Garcia, M. standing out for their consistent contribution to the theoretical and empirical development of the topic. This information is visually supported in Figure 5, which displays the authors with the highest number of contributions to the field. Among these 358 authors, 27.87% of the publications involved international co-authorship, revealing well-established collaborative networks between researchers from different countries and institutions.

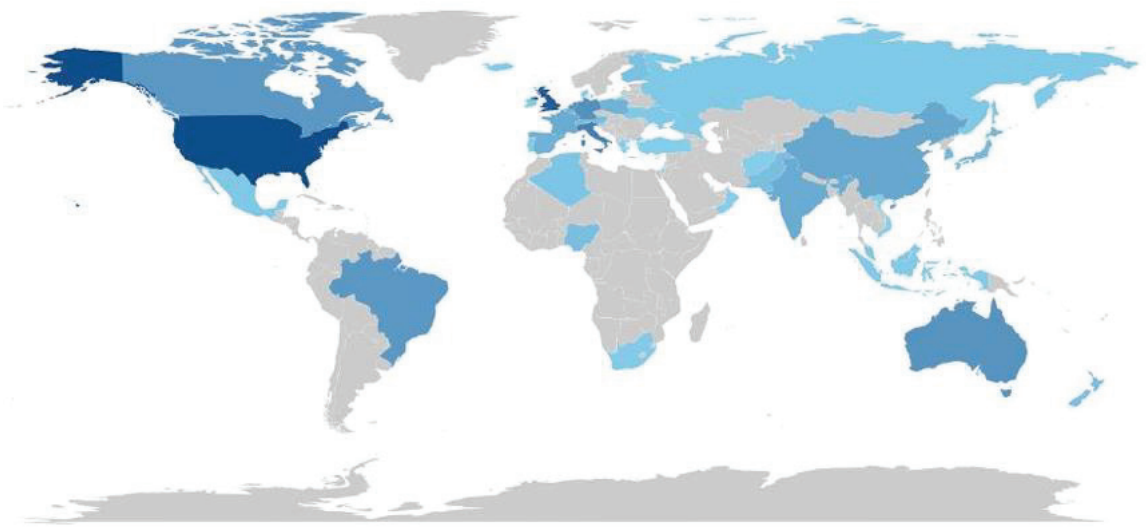
The geographical is reflected in figure 6, the analysis showed that countries such as the United States, the United Kingdom and Canada are among the leading contributors to the scientific output in this field, confirming its global relevance.

Figure 5: Leading authors



Source: Bibliometrix

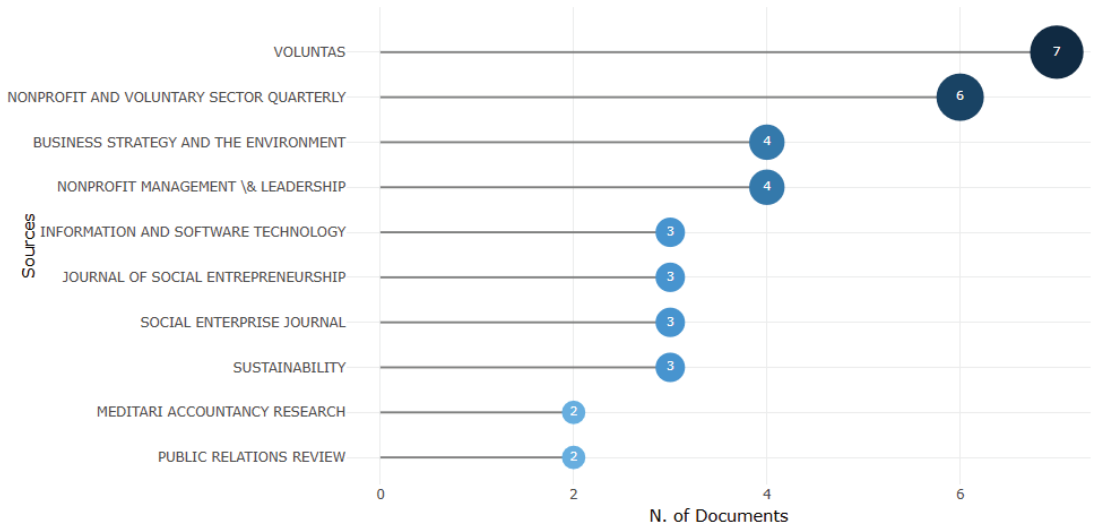
Figure 6: Country-level scientific production



Source: Bibliometrix

As shown in Figure 7, the most cited journals, *Nonprofit and Voluntary Sector Quarterly and Voluntas*, highlight the strong link between research in this field and the study of social economy organisations and social innovation. With an average of 15.37 citations per document, the articles demonstrate considerable academic relevance, potentially influencing new approaches to stakeholder management.

Figure 7: Most relevant scientific sources



Source: Bibliometrix

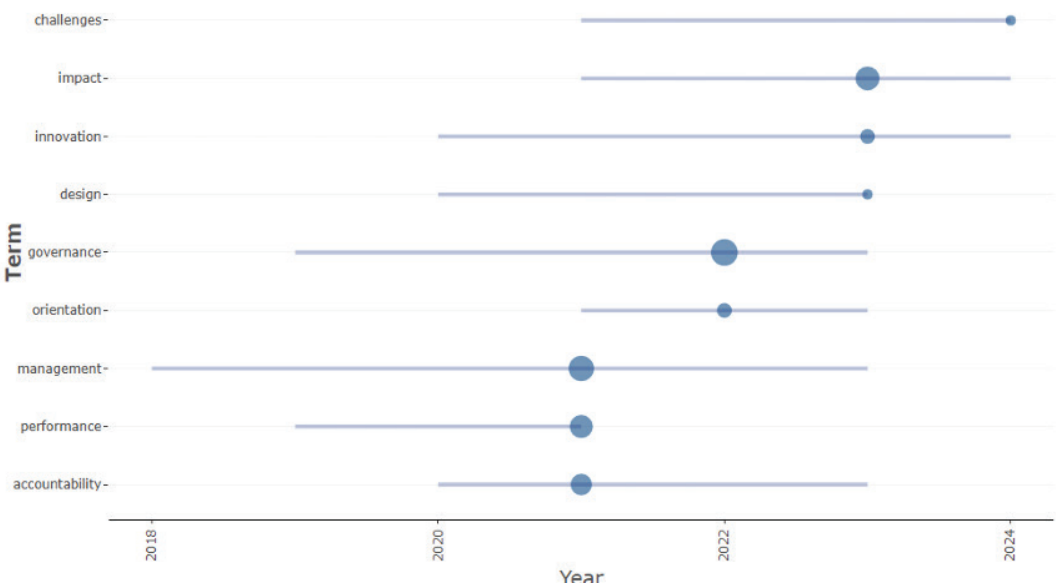
The most common terms in the bibliometric analysis *were management, impact, performance and organisations*, highlighting the focus on governance and impact assessment in social projects. These frequent terms are represented in Figure 8, which provides a visual overview of the most used keywords across the selected publications. The increasing presence of terms

such as *innovation* and *sustainability* suggests a shift in research priorities, reflecting a growing concern for strategies that address contemporary challenges. It is also possible to obtain a time graph of these terms, Figure 9, which shows the evolution of key terms over time - that is, when each topic began to gain relevance and how persistently it has been discussed over the years. Terms such as 'management' and 'performance' have longer lines, indicating that they have been discussed over a longer period. Terms such as 'challenges', 'impact' and 'innovation' have extended timelines to the present, indicating growing interest. Larger circles represent topics with greater intensity of discussion, notable examples being 'governance' and 'impact'.

Figure 8: Word cloud

Source: Bibliometrix

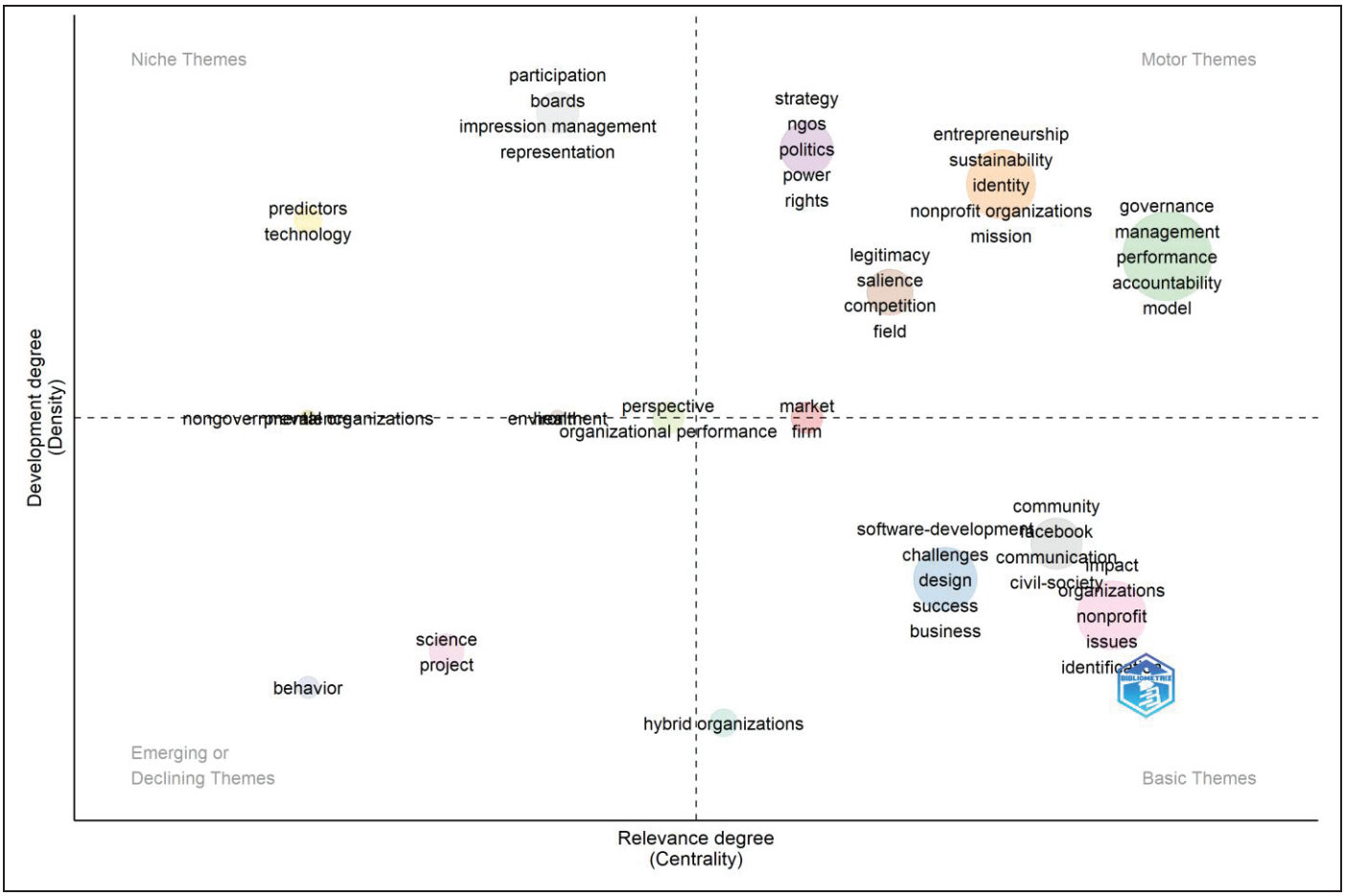
Figure 9: Trending topics



Source: Bibliometrix

The thematic mapping, figure 10, identified governance, management and performance as driving themes, indicating their fundamental role in shaping future research on stakeholder management. These appear in the upper-right quadrant, which represents motor themes — topics that are both highly developed (high density) and highly relevant (high centrality) to the field. Meanwhile, foundational themes such as community, impact and not-for-profit organisations are located in the upper-left quadrant, indicating areas with strong development but lower external relevance — essential for theoretical grounding. The lower-right quadrant contains niche themes, such as *predictors* and *technology*, which, while developed, remain peripheral to the broader field. Meanwhile, *hybrid organisations* and *behaviour* are positioned in the lower-left quadrant, indicating emerging or declining themes that warrant closer monitoring. The thematic mapping further highlights a research gap in social economy studies, suggesting the need for deeper theoretical and empirical exploration. It also reveals a shift towards the application of technological tools in stakeholder management, reinforcing the growing importance of data-driven approaches and digital solutions in engagement strategies.

Figure 10: Thematic Matrix of Centrality and Density



Source: Bibliometrix

5. Discussion and Conclusion

Stakeholder management is a fundamental process in project management and plays a crucial role in ensuring that all stakeholders are aligned and working towards the same goals. In the social economy context, where projects often involve a large number of stakeholders with diverse interests, achieving effective alignment must be a priority.

The literature review shows that stakeholder theory, originally developed for corporate contexts, has been widely applied to social economy projects. However, there remains a need to adapt its principles to the specificities of this sector, where community engagement and social impact are central elements. The literature also highlights significant differences in approaches to stakeholder management. The traditional methodology, characterised by a linear and structured model, facilitates the identification and categorisation of stakeholders. However, this approach can prove rigid and less adaptable to change, especially in dynamic and flexible environments (Pandi-Perumal et al., 2015).

Conversely, agile methodologies offer a more flexible alternative, promoting greater stakeholder engagement and continuous adaptation throughout the project lifecycle. These methodologies allow for rapid adjustments, ensuring responsive solutions to stakeholder needs. However, their inherent flexibility makes it more difficult to establish a standardised definition of the tools and techniques used in stakeholder management (Hobbs, 2017). Therefore, the choice of the most appropriate methodology depends on the project context. In many cases, a balance between structure and predictability (provided by traditional methodologies) and the adaptability of agile approaches may be necessary to optimise stakeholder management.

The bibliometric analysis revealed a growing scientific interest in the topic, highlighting its current relevance. However, it also showed that most articles do not focus directly on the practical application of stakeholder management tools and techniques, with these aspects appearing only indirectly, often in connection with broader themes such as governance, management, or innovation. In light of the research objectives, it is recognised that this approach contributed only partially to the intended goals. It responded more directly to the first research objective, by identifying how the topic has been addressed in the current literature through trends, key themes, and influential authors. It also provided indirect support for the third and fourth questions, by highlighting broader conceptual areas, such as governance, innovation, and performance, that relate to how stakeholder management is approached in different methodologies and within the social economy. However, the analysis did not directly or cohesively address the second objective, which aimed to identify and map concrete tools and techniques for stakeholder management. Nevertheless, based on the reviewed articles, it was possible to preliminarily and indirectly identify three categories of potentially relevant tools, albeit presented in a fragmented manner and lacking a systematic framework: (i) stakeholder mapping and categorisation, based on influence, interest, and role in decision-making; (ii) participation and direct involvement of stakeholders, with a focus on co-creation and formal representation in governance processes; and (iii) organisational listening, through formal and informal channels for the continuous collection and integration of stakeholder input.

With regard to the third objective—investigating the applicability of these tools in the management of social economy projects—it was found that the bibliometric approach does not provide sufficiently robust or contextualised insights.

It is therefore necessary to complement this bibliometric analysis with a more focused literature review that allows for a deeper exploration of concrete practices, empirical applications, and contextual relevance of stakeholder management tools in the social economy.Given the limitations and benefits identified, this study suggests that in certain

contexts a hybrid approach - combining traditional and agile methodologies - could offer significant benefits. Such an approach allows for the structure, predictability and comprehensive documentation of traditional models, while integrating the adaptability, speed of response, and continuous stakeholder engagement promoted by agile practices. This combination is particularly valuable in social economy projects, where dynamic social needs coexist with the requirement for accountability and performance measurement. By aligning detailed planning phases with iterative feedback cycles, hybrid approaches enhance communication, reduce stakeholder resistance, and allow for timely adjustments based on evolving project realities. This integration provides a more balanced framework for managing diverse stakeholder expectations while maintaining project focus and control. However, there are still gaps in the literature regarding this methodological integration. Future research could explore different aspects of improving stakeholder management in social economy projects, in particular by developing hybrid models that combine the structured framework of traditional methodologies with the adaptability of agile approaches. These models should be designed to meet the specific needs of social economy projects and ensure a balanced approach to stakeholder engagement. In addition, conflict management within stakeholder interactions is another area for further research. Given the diversity of stakeholders, tensions may arise that require effective mediation strategies to ensure cooperation and alignment. Both proposals could include an empirical research component to assess their practical applicability. In this respect, the issue of stakeholder management in the social economy: an assessment of tools and techniques could be further substantiated by more in-depth empirical studies, contributing to best practices in stakeholder management for social projects.

REFERENCES

Aderibigbe, A. & Fragouli, E. (2020): ***Reputation Risk from a Stakeholder Management Perspective,*** Risk and Financial Management, Vol. 2, No. 2, pp. 1–11

Al-Kharusi, H., Miskon, S., & Bahari, M. (2021): ***Enterprise architects and stakeholders' alignment framework in enterprise architecture development***, Information Systems and E-Business Management, 19(1), 137–181.

Aria, M. & Cuccurullo, C. (2017): ***Bibliometrix: An R-tool for comprehensive science mapping analysis***, Journal of Informetrics, Vol. 11, No. 4, pp. 959–975.

Cace, S., Arpinte, D., Cace, C. & Cojocaru, Ş. (2011): ***The Social Economy: An Integrating Approach,*** Transylvanian Review of Administrative Sciences, No. 33 E, pp. 49–66.

Claudius, A., & Barbosa, Q. (n.d.): ***"Terceiro setor", "economia social" e "economia solidária": laboratório por excelência de inovação social***, SOCTEM – Congresso Internacional Sociedade, Tecnologia e Empreendedorismo, No. 1, [no **pagination].**

Cojocaru, Ș., & Sfetcu, L. (2013): ***Partnerships in Social Economy***,Procedia - Social and Behavioral Sciences, 92, 197–201.

Da Silva, A. P., & Fernández, W. D. (2016): ***Significance of "contexts" in ICTD projects: Alignment and misalignment of stakeholders' interests,*** Proceedings of the Annual Hawaii International Conference on System Sciences, March 2016, 2708–2717.

Dong, H., Dacre, N., Baxter, D., & Ceylan, S. (2024): ***What is Agile Project Management? Developing a New Definition Following a Systematic Literature Review***, Project Management Journal.

European Commission (2020): ***Social enterprises and their ecosystems in Europe. Comparative synthesis report. Executive Summary,*** Publications Office of the European Union, Luxembourg, https://data.europa.eu/doi/10.2767/05369, (accessed 27 March 2025)

Fassin, Y., Deprez, J., Van den Abeele, A., & Heene, A. (2017): ***Complementarities Between Stakeholder Management and Participative Management: Evidence from the Youth Care Sector,*** Nonprofit and Voluntary Sector Quarterly, Vol. 46, No. 3, pp. 586–606.

Fonseca, L. M., Domingues, J. P., & Dima, A. M. (2020): ***Mapping the sustainable development goals relationships,*** Sustainability (Switzerland), Vol. 12, No. 8, [no pagination].

Fontana, E. (2018): ***Corporate social responsibility as stakeholder engagement: Firm–NGO collaboration in sweden.***, Corporate Social Responsibility and Environmental Management, Vol. 25, No. 4, pp. 327–338.

Gemino, A., Reich, B. H., & Serrador, P. M. (2021): ***Agile, Traditional, and Hybrid Approaches to Project Success: Is Hybrid a Poor Second Choice?*** In Project Management Journal, Vol. 52, No. 2, [no pagination].

Gemünden, H. G. (2015): ***From the Editor***, Project Management Journal, Vol. 46, No. 6, pp. 3–5.

Hansen, R. K. (2023): ***Applying a stakeholder management approach to ethics in charitable fundraising.*** Journal of Philanthropy and Marketing, Vol. 28, No. 4, [no pagination].

Hobbs, B. (n.d.): ***Agile Methods on Large Projects in Large Organizations,*** In Project Management Journal 3 Project Management Journal, Vol. 48, No. 3, [no pagination].

Marzi, G., Balzano, M., Caputo, A. & Pellegrini, M.M. (2024): ***Guidelines for Bibliometric-Systematic Literature Reviews: 10 Steps to Combine Analysis, Synthesis and Theory Development,*** International Journal of Management Reviews, Vol. 27, No. 1, pp. 81–103.

Melnikovas, A. (2018): ***Towards an explicit research methodology: Adapting research onion model for futures studies,*** Journal of Futures Studies, Vol. 23, No. 2, pp. 29–44

Moulaert, F. & Ailenei, O. (2005): ***Social economy, third sector and solidarity relations: A conceptual synthesis from history to present***, Urban Studies, Vol. 42, No. 11, pp. 2037–2053.

Öztürk, K., Kocaman, S., & Kanbach, D.K. (2024): How to Design Bibliometric Research: An Overview and a Framework Proposal, *Journal of Management & Governance*, Vol. 28, No. 1, pp. 3339–3365.

Pandi-Perumal, S. R., Akhter, S., Zizi, F., Jean-Louis, G., Ramasubramanian, C., Edward Freeman, R., & Narasimhan, M. (2015): ***Project stakeholder management in the clinical***

research environment: How to do it right, In Frontiers in Psychiatry, Vol. 6, No. May, [no pagination].

Radoynovska, N. (2024): ***Expectations Meet Reality: Leader Sensemaking and Enactment of Stakeholder Engagement in Multistakeholder Social Enterprises***, Business and Society.

Silva, A. S., Araujo, A., Palomino, P., Araujo, R., & Dermeval, D. (2024): ***Mastering Requirements Volatility: Strategies for Dynamic Environments and Multiple Stakeholders in Government Software Projects,*** IEEE Access.

Sjekavica Klepo, M. & Radujković, M. (2019): ***Usage of Project Management Methods, Tools and Techniques in Infrastructure Projects***, *in: Creative Construction Conference 2019, Proceedings*, Budapest University of Technology and Economics, June 29 – July 2, 2019, pp. 507–512.

Talbot, D., Raineri, N. & Daou, A. (2021): ***Implementation of sustainability management tools: The contribution of awareness, external pressures, and stakeholder consultation***, Corporate Social Responsibility and Environmental Management, Vol. 28, No. 1, pp. 71–81.

Udvaros, J., Forman, N. & Avornicului, S. M. (2023): ***Agile Storyboard and Software Development Leveraging Smart Contract Technology in Order to Increase Stakeholder Confidence***, Electronics (Switzerland), Vol. 12, No. 2, [no pagination].

Wellens, L. & Jegers, M. (2014): ***Effective governance in nonprofit organizations: A literature based multiple stakeholder approach***, European Management Journal, Vol. 32, No. 2, pp. 223–243.

A scientific paper

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TECHNICAL INNOVATION AND SUSTAINABILITY IN PUBLISHING PRODUCTION: RESPONDING TO TRENDS

ABSTRACT

This paper addresses technical proposals for adapting publishing production processes to two key trends in the publishing industry: reduced average print runs and increased individual titles. The current situation leads to increased production costs and requires the implementation of new technologies to ensure sustainable and efficient operations. The research in this paper includes technical possibilities of printing technologies (in-line color measurement, automatic plate changes), consideration of digital printing techniques (electrophotography, inkjet) compared to offset printing, and examination of color parameters (densitometry, spectrophotometry, gray balance) for optimizing quality and reducing costs. The paper provides concrete proposals for cost rationalization in two key areas: reducing the number of waste copies through precise color management and rapid machine calibration and increasing productivity by faster job changes. This work aims to analyze the latest technological trends and their impact on production costs in publishing, propose adaptations that printers can implement to increase efficiency, and investigate the effect of these techniques on sustainability and long-term business costs. The methodology consists of technical analysis and comparison of technologies (offset vs. digital printing), testing of color parameters, and a case study of publishing products with small print runs. Part of the research was conducted in three Croatian printing houses: Grafika Osijek, Radin Print, and Lana. The results of this research provide a comprehensive technical response to the key challenges of modern publishing: reduced average print runs and increased number of titles, which significantly affect production costs and profitability. Implementing advanced technologies enables the rationalization of the production process, while optimization of color parameters reduces waste copies and increases job changes' efficiency. These technical approaches ensure two key benefits for publishers: reduction of resource losses and costs that directly contribute to financial sustainability and environmentally acceptable production, improvement of operational efficiency, and increased business adaptability to market demands, especially in dynamic crisis conditions. The contribution of this work is reflected in the development of a broader entrepreneurial ecosystem, where innovation integration, resource optimization, and adaptation to modern business trends play a crucial role. The paper also provides guidelines for the long-term positioning of the publishing industry as an essential part of a sustainable economy.

Key words: *publishing trends, production, closed-loop color management, densitometry, spectrophotometry, gray balance.*

1. Introduction

The publishing industry is undergoing significant changes driven by technological innovations and an increasing emphasis on sustainability. This research explores the roles of technical innovations and sustainability in publishing production, analyzing reduced average print runs and other sustainable approaches that impact business segments and overall publishing production.

Analyzing general trends within the publishing industry reveals a characteristic reduction in average print runs. It affects many business segments within publishing, as well as publishing production itself. Over the past few years, the publishing industry has begun implementing strategies to reduce average print runs to decrease waste and improve production efficiency. Print-on-demand (POD) technology allows for printing books by order, significantly reducing the need for large initial print runs and impacting waste reduction. This technology is both environmentally and economically viable as it avoids storage and disposal costs for unsold copies (Boboc, 2024). Sustainable approaches in the publishing industry have a positive impact on business segments. For example, using recycled paper, soy-based inks, and biodegradable packaging not only has an environmental impact but also contributes to improving a company's image among consumers who increasingly value environmental awareness (Larson-Burnett, 2024).

Understanding how technical innovations and sustainability affect the publishing industry is crucial in the context of these changes. Based on this, the following sections of this work will thoroughly investigate technical proposals for adapting publishing production processes, particularly in reducing average print runs and increasing the number of individual titles.
There are fixed and unchanging elements of production that must be achieved regardless of the total print run. These include variability in production costs depending on the print running size. Publishing products are mostly printed using offset printing, which requires the creation of printing plates for each color and page. More precisely, offset printing is an indirect printing technique within the flat printing segment, where printing and non-printing elements, i.e., printing and non-printing surfaces, are separated by a chemical process. On the one hand, printing surfaces are prepared to become oleophilic and hydrophobic, accepting oily ink for printing publishing products. On the other hand, non-printing surfaces are hydrophilic and oleophobic, preventing the penetration of printing information onto non-printing surfaces in the moistening environment. During the process, the chemical property of surface tension between two different mixtures of substances helps. The process, which is captured or reproduced onto physical metal plates, becomes the carrier of the printing form and is physically mounted on the offset printing machine, becoming the matrix for the printing phase. Each produced printing plate contains information for one color and one printing form. To print the entire printing sheet, it is necessary to print both sides of the sheet to obtain a print on all pages (Kiphan, 2001). Therefore, two printing forms are required. For example, most publishing production occurs within CMYK color separation (cyan, magenta, yellow, and black), i.e., using primary colors of subtractive color synthesis. It is concluded that four plates are needed to print one printing form, i.e., eight plates for the entire sheet (Bolanča, Golubović, 2008, 135).

Depending on the book's scope (number of pages) and the final format of the printing machine, it is evident that many printing plates often need to be reproduced. This process is identical for all books, regardless of the print run. The fixed cost of printing plates is also the same, irrespective of the print run. It leads to high fixed costs, especially for small print runs.

The reduction in print runs in the publishing industry presents challenges for adapting to minimal print runs, particularly in printing form production costs. As the print run increases, fixed costs become more acceptable. Based on this, it is concluded that researching processes that can reduce production and pricing variables in printing form production becomes increasingly important.

In conclusion, technical innovation and sustainability in publishing production represent key factors that will shape the future of this industry. Through reduced print runs, the use of sustainable materials, and digitalization, publishers can achieve better efficiency, minimize environmental impact, and improve their market image. With this approach, the publishing industry can achieve more sustainable operations through economically and socially responsible practices. Through the research conducted for this work, it is possible to find methods for reducing production and pricing variables in printing form production.

1.1. Process of Changing Printing Forms

When it comes to the metal alloys used for printing forms, it is not just about the cost of producing them as carriers of the printing form. It is also about the time required to change the plates on the machine, i.e., the time needed to prepare for a new job after the previous one has been completed. It is especially true if it involves a book of significant scope, i.e., more sheets and printing forms.

As mentioned earlier, producing eight plates, four for each side, for a classic CMYK sheet is necessary. Along with other regular procedures for changing jobs in offset printing, managing ink fountains and overall coloring (especially if we have any additional colors outside the CMYK range), various washing structures for rubber and printing cylinders, as well as the coloring rollers themselves, it results in a time-consuming process of changing all the prescribed procedures necessary for preparing a new job. It is particularly evident when these procedures are performed sequentially, one after another. In an increasingly smaller print run environment, only about 1/3 of the total production time is often spent on actual printing. The rest usually consists of various preparatory actions, as described.

Therefore, it is necessary to investigate possibilities to reduce the processing time for changing printing forms and make publishing production more rational.

1.2. Commencement of Printing

In addition to the procedures for creating and mounting plates and preparing other phases necessary for changing between two jobs, a crucial element for the successful start of printing is aligning colors and tones with the desired and reference test prints, considering graphic preparation. In economic terms, this process has two key components that need to be investigated.

It is important to determine the time required to align all color information and achieve an acceptable commercial print. In this production phase, it is common to lose a significant amount of time, sometimes even an entire hour, aligning all qualitative information with inputs from the design and graphic preparation areas and aligning with current standardization.

It is particularly evident when printing two colorfully wholly different jobs, one after the other— one with minimal color and color information, another with minimal color, and very delicate areas in the intended print. Furthermore, when we have uneven color information on a specific printing form—e.g., on the left side, a lot of CMYK color information with high color coverage; on the right side of the form, the opposite, e.g., captions under images in two or three places, only in black, and when using some additional color from the sample, as well as some

unique color, e.g., gold, or a color that carries some identity and is not printed within the CMYK environment.
In addition to the time needed for all alignments, it is also very significant how many print samples were consumed during this alignment, representing waste and a fixed cost.
Therefore, it is necessary to investigate methods for reducing the time required for initial color alignment, print quality, and the number of waste samples, all in the interest of more rational publishing production.

2. Methodology

The following research methods are used for the experimental part within the three designated research areas. Industrial catalogs of leading printing machine manufacturers were thoroughly analyzed and researched in the regions that elaborate on the three areas. Investigations and discussions on automation were conducted with experts from practice. Production processes within specific printing systems were physically observed and measured, both with and without automation systems used in the research. The research was conducted in three printing houses in Croatia: Grafika Osijek, Radin Print, and Lana. Furthermore, an analysis of existing research within these areas was carried out.
Consequently, the research's contribution is evident in the comparison of the obtained results with the declared factory parameters that served as the source of the research.

3. Results

The procedures for creating a printing form, whether for offset printing or any conventional printing technique, cannot be avoided. For every conventional printing technique, a matrix, i.e., a printing form, is required. Sometimes, this involves offset printing with metal alloy plates, sometimes flexible polymer forms, or engraved copper rollers (when investigating the area of flexible packaging).
Therefore, we conclude that only digital printing techniques are suitable for the printing phase if one wants to avoid the necessity of creating and using a matrix, i.e., a conventional printing form. These techniques do not have a physical printing form, i.e., they have a virtual form. In simpler terms, they involve communication between graphic preparation and printing via computer memory, which takes on the role of a virtual form. Only in this way can the creation of a real and conventional form be avoided.
When investigating digital production within the area of publishing production, particularly in the local environment, it is concluded that only two digital techniques dominate: electrophotography and inkjet. Inkjet is the technology used in this work to observe and conduct research. Specifically, a continuous Inkjet system was observed. The Inkjet system involves liquid ink that continuously circulates through the nozzle; when part of the liquid is directed towards the printing substrate, the rest returns to the tank via a return pipe, preventing the drying of the ink on the nozzle and nozzle blockage (Majnarić, 2022, 161). Electrophotography is a non-contact digital printing technique that falls into the category of printing techniques. Electrophotographic digital machines that use powdered or liquid toner are distinguished. However, regardless of the toner digital devices use, the printing form is variable and virtual (Majnarić, 2007, 45).
The research was conducted in the following way: physical visits, recording of conditions, and investigation of calculations by a printing house that deals with both digital and conventional methods of printing and publishing products. It is also the primary method of research in digital

printing. An analysis of certain boundary areas of profitability of printing within one of the mentioned options was conducted at the "Grafika Osijek" printing house. By measuring and observing, a record of the general characteristics of the printing process and their mutual comparison was made.

Two opposing characteristics were noted when observing the calculation analysis. Digital printing, as mentioned, uses a virtual printing form, so the cost of creating a printing form does not exist. On the other hand, there is a significant difference in the price of coloring between the two systems that are the subject of the investigation. Physical coloring within the observed inkjet technology is several times more expensive than industrial coloring in conventional offset printing.

Suppose the later observed general properties related to speed, formats, coloring, and other characteristics are disregarded. In that case, the entire economic calculation relates to finding the break-even point for both printing techniques: the larger the print run, the cheaper offset printing becomes per print cost due to the difference in coloring costs. For smaller print runs, digital printing is more cost-effective because it does not incur the cost of creating a printing form.

However, this cost is influenced by numerous additional parameters. Primarily, these relate to the book's scope/number of pages. The more pages there are, the greater the cost of creating a printing form. When using the observed methods, it was noted that the last-mentioned characteristic significantly increases the complexity of comparing calculations, i.e., the cost per print. More precisely, if the number of pages in the book rises, for example, by 100 pages, the break-even point is much higher within digital printing. For this reason, the research focused on three basic scopes—100, 150, and 200 pages. The scopes were compared by projecting three print runs: 100, 500, and 1000 copies of books. As previously mentioned, the production costs were analyzed and compared within the commercial/technical department of the printing house. The results obtained showed that in each of the investigations mentioned, a print run of 100 copies was more cost-effective using digital printing and that any print run of 1,000 copies or more was more cost-effective in offset printing. In the middle ranges, these significantly depend on page scope, number of colors, and color coverage. Specifically, the research revealed (primarily due to the significant difference in coloring costs) that many digital printing systems of newer production come with a computer transformation of the original CMYK print. It involves a method where the print is re-separated within the area of color values so that certain CMY areas are reduced at the expense of the K color area. The economic benefit is that the inkjet industry's black ink (K) is significantly cheaper than the CMY solution. For this, advanced knowledge in repro photography and graphic preparation is necessary.
After extensive research and several case studies, the following basic characteristics of printing can be listed. The research was conducted in the following areas: print quality, choice and availability of colors, speed of creating a printing form, speed of reaching the necessary level of saleable quality, availability of different formats, availability of different configurations, and printing speed.

Print Quality
The method of visual observation and physical measurement of print quality using densitometry (Majnarić, 2022, 162) was employed. Significant deviations and differences are challenging to detect within basic printing, i.e., within the CMYK method of color separation and printing. There are specific differences in the quality peaks. However, they are not so significant for ordinary consumers. Prints produced by digital technology are acceptable and competitive.

There are, as indicated, some cosmetic defects. Slight traces of paper transport over the rollers of the digital machine are sometimes observed when it comes to continuous tones, which are significantly darker continuous tones. It occurs sporadically and is not critical enough to conclude that it represents a significant deficiency for commercial printing.

Color Selection and Availability
If we are within the CMYK range (the most common area of publishing production), the selection and availability of colors are sufficient. However, when speaking of special and unique colors, there are significantly greater possibilities within conventional printing. Although the world of digital printing is showing great industrial development advances in this direction, it still lags in color selection compared to conventional printing.

Speed of Creating a Printing Form
There are no dilemmas in this area. Digital printing is unbeatable in this area if there is quality IT infrastructure. The speed of creating a virtual form is instantaneous. Offset printing involves significantly more time, depending on the type of print and product complexity. Regardless, it typically requires spending about 20 minutes per printing form. These are incomparable differences.

Speed to Reach Saleable Quality
Again, we find ourselves in an area with a massive benefit for digital printing. It takes up to one minute. Conventional printing takes about 20 minutes, but it can be shorter with available automation. In the six jobs we observed and analyzed, the average time to reach a quality print ready for sale was 21 minutes.

Availability of Different Formats
The printing house mentioned used identical formats, B2. However, analyzing the market and environment, it can be concluded that offset printing formats are significantly more advanced and variable. They involve machines with B1, BO, and even larger formats. In digital printing, production is possible within the A3-B2 format range, which is the lower limit of profitability for publishing production.

Availability of Different Configurations
Offset printing allows for much greater flexibility. In addition to larger formats, significantly different configurations are possible. In the subject printing house, B2 systems with four colors were observed and analyzed. Thus, the sample was identical. On the other hand, studying the general market, offset printing also enables 8-color machines to turn. It allows double-sided printing, with both sides of the printing form being identical. In digital printing, this requires printing twice.

Printing Speed
Offset printing is capable of printing at significantly higher speeds than digital printing. It involves a difference of 3 or 4 times.

3.1. Process of Creating and Changing a Printing Form

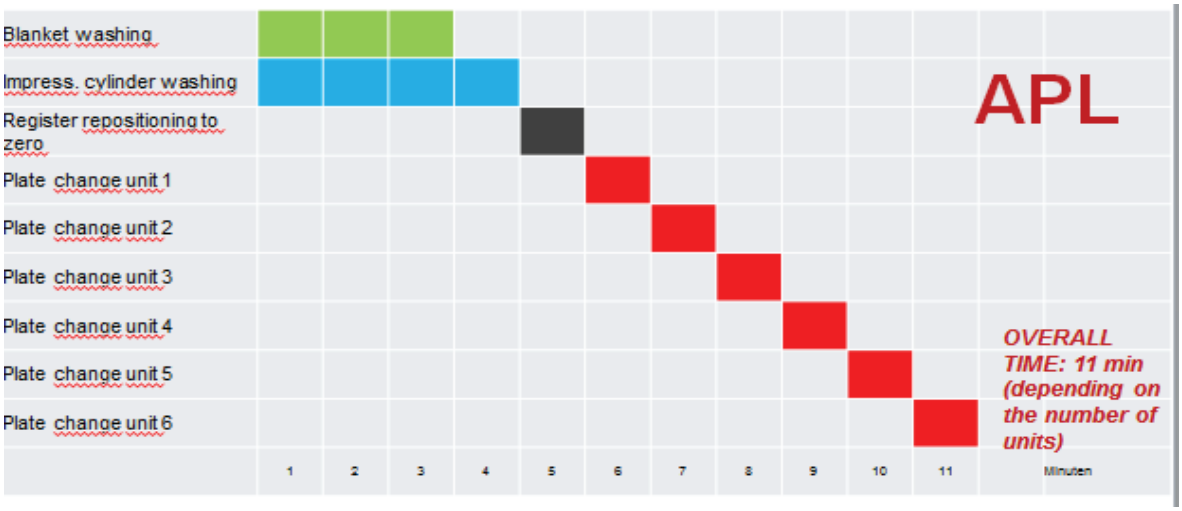
As mentioned in the research description, there is a significant difference between the printing technologies being investigated in creating a printing form. In digital printing, creating a virtual printing form is almost instantaneous, while starting commercial printing—conventional offset

printing, as the primary representative of industrial publishing printing—presents a challenging task in both categories.
Simply put, the time required to create a printing form (in the subject printing house, an average duration of 21 minutes) and the time needed to align color information and other parameters on the machine are necessary. It primarily concerns washing the coloring rollers, printing, and offset cylinders. As mentioned, it involves a time-consuming process.
In the printing house mentioned, there is no additional automation in the two key areas of offset printing: automatic plate changing and automatic color measurement.

3.1.1. Automatic Plate Changing

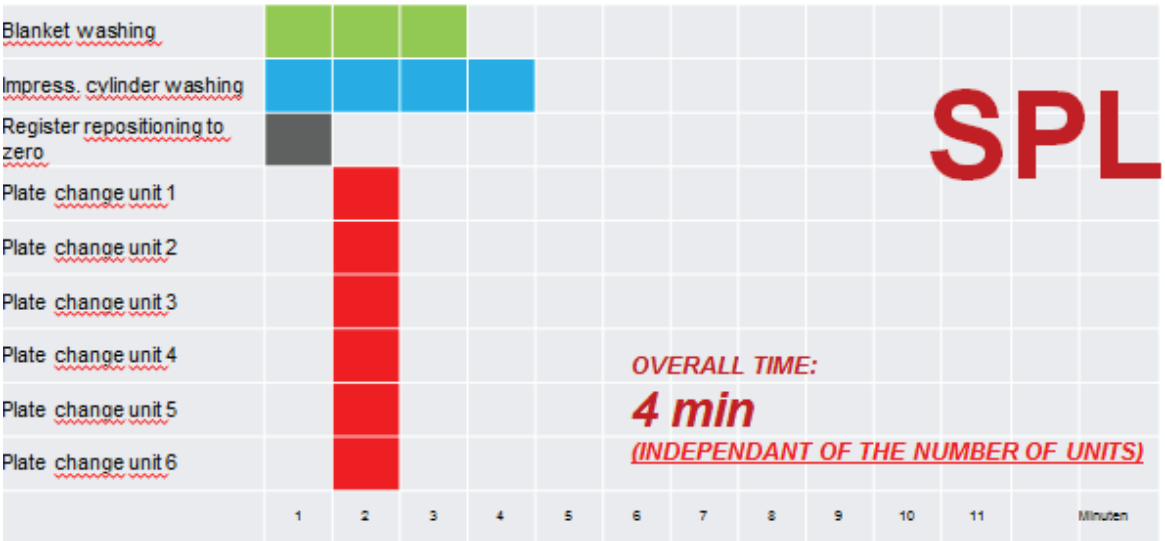
The research continued at the "Radin Print" printing house to investigate optimal possibilities and provide proposals for automation solutions. The "Radin Print" printing house can test the two automatic functions mentioned.
The changing of the printing form involves a parallel/simultaneous method of changing plates. This method refers to plates that are changed in parallel on all printing units, while other necessary actions, primarily washing, are performed at the same time. The starting point for the research was the declared industrial parameters shown in the following scheme (figures 1 and 2).

Figure 1: Classic plate changing lasting 11 minutes. The parallel plate changing system is marked in red



Source: manrolandsheetfed.com

Figure 2: Parallel/simultaneous plate changing lasts 4 minutes. The parallel plate changing system is marked in red



Source: manrolandsheetfed.com

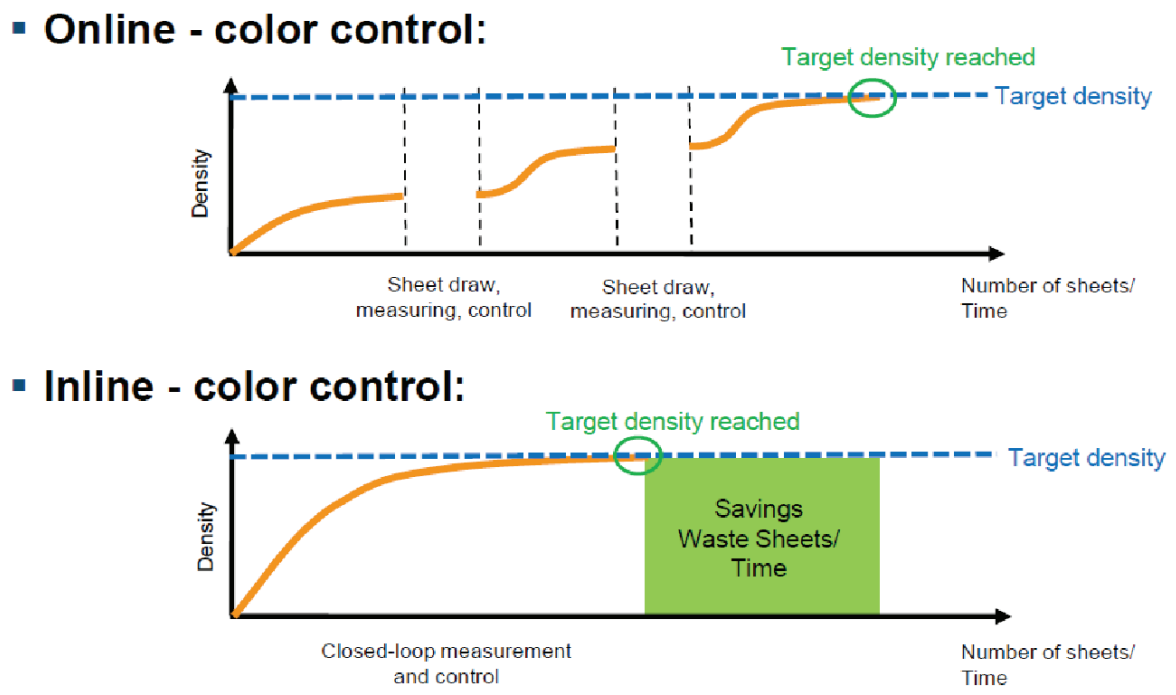
From the visual representations, the following can be observed: various necessary forms of preparation and washing of the machine before each job (washing coloring rollers, washing cylinders) are fixed elements that do not change, regardless of the automation of plate changing; on machines with the mentioned automation, washing occurs in parallel during plate changing; on machines without automation, plates are changed one after another, each printing tower separately; on machines with the mentioned automation, the process occurs in parallel.
It was impossible to test the precise image because it relates to a partially different configuration than the machine on which the research was conducted. However, the unit times overlap significantly. By analyzing the seven jobs that were measured, it was shown that they achieved an average savings of 11 minutes compared to systems without automatic plate changing. These results represent a significant benefit, especially in the area and environment where we witness increasingly smaller print runs.

During the research period (two days), the printing house performed an average of 18 plate changes per day (three shifts). It leads to the conclusion that saving almost 198 minutes per day is possible. This function saved nearly three working hours on a single machine.
More savings are possible considering the machine configuration (five colors) and market analysis. Specifically, as mentioned, eight-color machines are becoming more prevalent. Additional savings are achieved for each additional unit. In such printing houses, the expected time benefits when comparing machines with and without parallel automatic plate changing—in the case of the 18 changes mentioned mentioned to almost four hours.

3.1.2. Automatic Color Measurement

Automatic color measurement involves comparing manual control and automatic in-line control. Manual control consists of taking a sample/print from the machine, stopping the print, measuring quality on a console, and making corrections. All these phases involve time consumption and significant expenditure of repro materials. Due to the new color alignment, every machine stoppage produces non-productive time and additional waste material.
The work starts with the initial assumptions analyzed in industrial catalogs (figure 3).

Figure 3: Systems with and without in-line automation for measuring color values. The green area represents the expected savings



Source: manrolandsheetfed.com

The technical characteristics related to Figure 3 were tested at the "Lana" printing house. The "Lana" printing house was chosen due to its adequate system for automating color measurement. The research presents systems with and without the mentioned automation and the benefits in cases where machines are equipped with such systems. For the research, analyses were performed based on reading densitometric values. In essence, the testing of printing houses equipped with in-line measurement systems works as follows: determining the desired densitometric values for the entire CMYK color separation, loading these values into the machine, then achieving satisfactory print quality, and the machine automatically (with the help of densitometric devices on the machine itself, distributed across the entire width of the sheet) measures and maintains the desired values.

In a system without the mentioned automation, frequent machine stops, manual controls, measurements, corrections, and restarting the machine from the beginning are necessary. Such a system consumes incomparably more time and wastes samples. In the mentioned research, the following parameters were recorded: 17 minutes was the average time required to achieve acceptable print quality in the case without automation; 224 sheets were averaged as paper waste; an additional 20 minutes were spent through manual control 4 times throughout the entire print run; an additional 120 minutes were spent on color correction.
In the system with automation, the following values were recorded: 12 minutes was the average time required to achieve acceptable print quality; 92 sheets were averaged as paper waste; zero minutes were spent through in-line control throughout the entire print run; and zero sheets were spent on color correction.

The systems are incomparable in rationalization, i.e., time and waste sample savings. The larger the print runs, the more frequent the intermediate controls, and the greater the time and number of waste samples consumed in systems without control.

4. Interpretation of Results and Conclusion

Maintaining publishing production as rational and economically viable is challenging, especially when analyzing trends indicating smaller print runs.
Fixed elements and fixed costs, which are present regardless of the print run, must be as rational as possible. If the configuration of offset printing machines is analyzed, numerous automation systems are available to publishers and printers.

For this work, an analysis of automation in automatic, parallel, and synchronous plate changing was conducted. The system proved to be highly efficient. It showed that saving several hours daily is possible, i.e., making production faster and more efficient. The precise time depends on the number of sheets, the number of books, and the number of shifts throughout the workday. It also depends on overall organizational discipline and competence.
The automatic in-line color control system also demonstrated numerous advantages and benefits in terms of time consumed and the number of waste samples. The system is particularly evident in larger orders, i.e., larger print runs, when the book has an enormous scope.
These two systems enable savings of several hours during the workday and several thousand samples in waste.

Digital printing showed significant efficiency in small print runs. It is an excellent opportunity for printing houses to have both technologies available. Then, they can create precise calculations and calculate the break-even points, considering the print run, number of colors, number of pages, and color coverage.
It is impossible to determine precise boundaries from the outside. However, we are dealing with a print run of several hundred copies. Digital printing is a cost-effective solution, especially if the book has many pages.

This boundary is even higher if the book is black-and-white. Thus, we find an acceptable area for specific scripts, university titles, and similar works.
In such cases, it is necessary to oppose additional economic parameters, which were not the subject of this research. Specifically, it is essential to resolve the fundamental economic dilemma.

For example, what is the optimal economic option if there is a need for some title with 200 copies per year? Regarding the print itself, we have demonstrated that it is digital printing.
However, the question arises—if a publisher decides on a print run of 1,000 copies, knowing that the book will be sold over five years, what is the cost of capital and inventory for those five years? Other economic questions also arise. However, these questions will be answered in future work through new research.
Additionally, only two automation systems were observed. Numerous additional systems enable rational publishing production, and these additional systems are also elements of future research.

In conclusion, as evident from the research part of this work, automation systems significantly burden publishers and printers financially. A feasibility study for each of them is necessary.

Only when it is proven that the hours saved and savings in waste bring economic viability is it essential to equip machines with such systems.

This work's contribution is to show the path and methods for making publishing production more rational and economically viable. The term "shown path" is used because, as mentioned, many additional segments will be described in other research.
The limitation of this work is that the analysis is conducted in real industry and production, and each printing house has some elements of automation and testing capabilities, but some lack them. A limitation is also that it is possible to measure time and observe processes, but only with the permission of the printing houses. Certain segments can be measured in print quality. However, these are not laboratory conditions where measurements are precise and other parameters are isolated.

Regardless, the author's stance is that, based on the research, the correct path to rationalizing publishing production has been presented. This conclusion is also shared by authors Bolanča et al., who, in their 2020 work, conclude that because Croatia is not a populous country, small print runs, in most cases, satisfy machines with small capacities. They expect larger print runs to be achieved in future rotations for newspaper printing and packaging printing. They also highlight the trend of expanding flexography and the fact that conventional techniques are trying to reduce the cost and time needed to fulfill orders to become more competitive for small print runs. While digital machines are trying to achieve incredible speed and competitiveness for large print runs (Bolanča et al., 2020).

REFERENCES

Boboc, D. (2024): ***How Eco – Friendly Publishing becomes a standard in the industry***, in: Lap-Publishing.com (2024): https://blog.lap-publishing.com/title-the-advantages-of-eco-friendly-print-on-demand-sustainable-publishing/ (accessed 24 March 2025)

Bolanča, S. (1998): ***Glavne tehnike tiska*** // Acta Graphica. GATF Encyclopedia of Graphic Communications, GATFPress, Pittsburgh, pp. 298–302.

Bolanča, S. & Golubović, K. (2008): ***Tehnologija tiska od Gutenberga do danas,*** Senjski zbornik: prilozi

Bolanča, et al. (2019): ***Hrvatska tehnička i industrijska baština na području tiska,*** Godišnjak Akademije tehničkih znanosti Hrvatske, Vol. 2019, No. 1, pp. 51-63

Kipphan, H. (2001): ***Handbook of print media: technologies and production methods***, Springer

Majnarić, I. (2022): ***Mjeriteljstvo u tisku i periferna tiskarska oprema***, Grafički faklultet Sveučilišta u Zagrebu, Zagreb, 161-164.

Majnarić, I. (2015): ***Osnove digitalnog tiska***, Grafički fakultet Sveučilišta u Zagrebu, Zagreb, pp. 157.

Majnarić, I. (2007): ***Studija indirektne elektrofotografije: doktorska disertacija,*** Grafički fakultet Sveučilišta u Zagrebu, Zagreb

Manrolandsheetfed (2025): https://www.manrolandsheetfed.com/ (accessed 15 March 2025)

Larson, B. (2025): ***Publishing trends 2025***, in: Atmosphere press (2025): https://atmospherepress.com/publishing-trends-2025/ (accessed 20 March 2025)

A scientific paper

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ANALYSING THE PREFERENCES OF WINE CONSUMERS USING MULTI-CRITERIA ANALYSIS

ABSTRACT

Wine research and the preferences of wine consumers have been the focus of interest for many scientists over the last two decades. One of the reasons for this is that wine is more than just a product for consumers and wine can also be seen as an experiential good, which means that consumers can only judge its quality after consuming it. It is therefore important to research their preferences in order to understand which characteristics of wine influence their purchasing decisions. Analysing wine consumers' preferences is important so that producers can adapt their production and sales strategies to current demand. The aim of the study is to find out which factors have the greatest influence on the purchase of wine and then to rank the types of wine based on consumer preferences. The importance of the individual criteria that influence the consumer's choice of wine and the motivation for this choice are analysed in this article with the help of the Analytical Hierarchy Process. The alternatives used in the analysis are the most popular white and red wine varieties, as most red and white wines are produced in the Republic of Croatia. The main criteria selected for the analysis are mainly related to the market characteristics of wine and the characteristics of wine quality. The criteria were selected on the basis of the researched literature and those that were mentioned most frequently were chosen. The following wine quality criteria are used: aroma, acidity, sugar content, alcohol content, vintage and geographical indication. As far as the market characteristics of the wine are concerned, the study uses the criterion of wine price. The most important criteria chosen by respondents when buying wine were the sweetness of the wine, the price of the wine and the aroma of the wine. Muscat Ottonel was chosen as the best alternative for white wine and Plavac Mali for red wine. The results of the analysis show that the average wine consumer in Croatia has a high level of education, lives in a family with a monthly income of up to 4,000 euros, buys wine directly from the producer and favours white wine as well as semi-sweet and semi-dry wines.

Key words: *wine, preferences, consumer, multiple criteria analysis, AHP.*

1. Introduction

Wine is a globally recognized and economically significant product that brings together not only consumers in moments of togetherness and celebration, but also the business and academic community interested in market trends, consumer preferences and legal challenges. Products such as wine are of interest to researchers because wine is more than just a drink or a product for consumers; it is seen as an experience good. An experience good is a product whose value characteristics are difficult to determine and impossible to know before the product is tried out (Kaštelan Mrak, Kaštelan, 2023).

Preferences are defined as subjective comparisons between two alternatives (von Wright, 1963) that do not require a ranking of all possible options, but only pairwise comparisons. Products like wine are particularly interesting because consumers are often not indifferent to them, but they may not be fully aware of their preferences or be able to explain them clearly (Katunar, 2024). This can be due to a variety of factors, including personal preferences, social norms, aesthetic preferences and perceptions of quality. Wine is such product where it is important for consumers to make choices. Analysing consumer preferences for products such as wine may involve examining various characteristics of the wine, such as variety, region of origin, vintage, taste, aroma, production techniques and many others. The research in this paper is concerned with analysing consumer preferences based on the characteristics of the wine variety.

There are many reasons for conducting this research. Croatia is a country with a long tradition of wine production. The culture of wine drinking is highly developed and wine production has become one of the most recognizable agricultural activities. At the same time, however, producers face many problems and challenges, such as large-scale wine imports, lack of competitiveness of the domestic product, problems with supply chains, poor negotiating position of small producers, etc. Researching consumer preferences has become crucial for developing a competitive advantage for Croatian wine producers.

A combination of quantitative and qualitative research methods is often used to better understand consumer preferences and tailor products and marketing strategies to their needs and desires. Consumers' understanding of wine quality is a multidimensional construct that is highly dependent on their level of involvement. Research shows that consumers who are more involved tend to conceptualise wine quality more objectively using cognitive dimensions, while less involved consumers evaluate wine quality subjectively using sensory dimensions (Charters & Pettigrew, 2007).

The aim and purpose of this research is to use the multiple-criteria approach to rank wine types based on preference and determine which factors influence wine purchases the most. Another aim of this research is to investigate the degree of importance of each criterion that influences a consumer's choice when buying wine and the consumer's motivation for making that choice. Based on the aim and purpose of the work, a research question was defined: What are the most important criteria that influence consumers' wine purchasing decisions and how are different types of wine ranked according to consumer preferences using multi-criteria analysis?

The research findings are important for wine producers to adapt their production and marketing strategies to current market trends and consumer preferences. The article is organised as follows. After a brief literature review, the methodology and results are presented. The concluding part of the paper contains the results of the research, its limitations and recommendations for future research.

2. Literature review

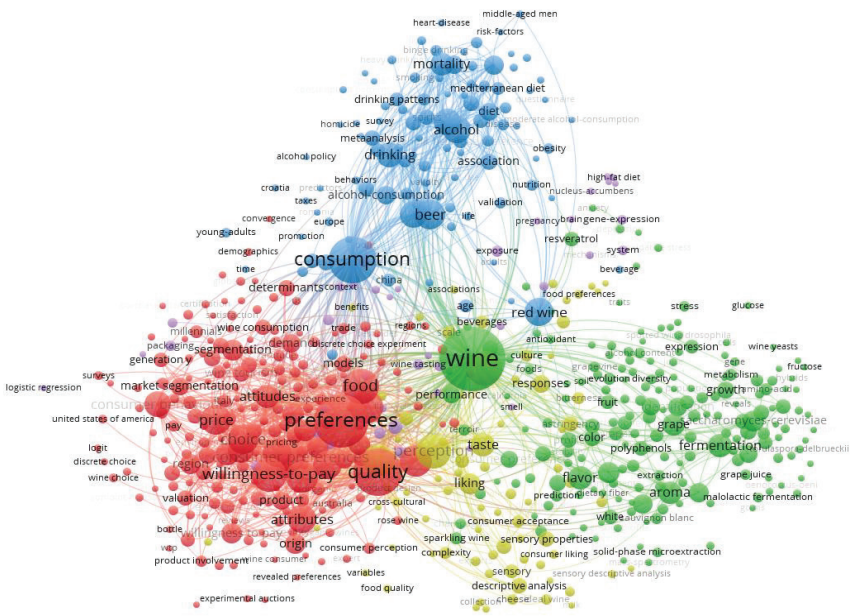
Croatia has a long tradition of wine production. According to data from the Vineyard register, in 2023 there were 17,278 hectares of vineyards and 560,789 hectolitres of wine were produced. Given Croatia's tourism capacity, Croatia is also the largest wine importer in the region. According to the Croatian Statistical Office (www.dzs.hr), wine imports in 2023 totalled 46 million euros, while white wine exports amounted to 19 million euros. This data indicates a significant trade deficit in the wine sector.

Wine is not perceived as an ordinary alcoholic beverage, but enjoys a special status compared to other alcoholic beverages due to its role in everyday social events, numerous wine events and a long tradition of wine production in Croatia. In the face of increasing competition on the wine market and changing consumer preferences, producers are focussing on consumer needs and wishes when developing their business strategy.

To find out which criteria are most important to consumers when buying wine, the following databases of articles on wine selection were searched.

Numerous articles, papers and publications have been written on the subject of multi-criteria decision making or decision making using the Best-worst scaling (BWS) method. In order to select the most relevant ones, it is necessary to search the databases thoroughly. The database used for this review is Web of Science. The database contains a large number of articles and papers corresponding to the research topic. In addition, the databases allow exporting data that will later be used to create a biometric network in the Vosviewer programme. The first step in searching the databases was to select keywords: Wine, Consumer Preferences and Ranking, which were carefully selected to ensure that the search was comprehensive and included relevant research.The search results were then analysed to highlight the most common keywords, identify the most relevant papers and identify the "hottest" research areas based on the keywords. In the remainder of the article, only a graphical representation of the keywords and their clustering will be presented, on the basis of which criteria for further multi-criteria analysis will be extracted.

Figure 1: Visualization of key terms from the Web of Science database



Source: Author's work in the program VOSviewer

Figure 1 shows a visualisation of bibliometric networks that include journals, research papers or individual publications and were created on the basis of citations, bibliographic links, co-citations or co-authorship relationships. The visualisation was created using the software tool for creating and visualising bibliometric networks, "VOSviewer". The data was collected from the Web of Science website and included 1,776 selected publications based on the keywords. The figure shows 4 clusters, coloured red, yellow, blue and green. Each cluster is of a different size, which shows the importance of the respective cluster. The larger the cluster, the more frequently a particular term is mentioned in the literature. The red cluster is related to consumer preferences and the purchase of wine, which is determined by the quality of the wine and the market characteristics of the wine. The green cluster is related to wine production, and the blue cluster is related to wine consumption. In addition to colour and size, the representation of a particular term in the biometric network is also represented by lines visible between the circles. The length of the lines indicates the degree of connection between the terms; the shorter the line, the greater the connection between the terms. Short lines indicate a close connection or frequent co-occurrence of terms in the literature, while longer lines indicate a weaker connection. This type of visualisation helps to understand how different terms and concepts are connected within a research area and allows researchers to identify important themes and trends. The literature on consumer preferences and wine selection is very well researched given the large number of publications. Below is a brief overview of the research on consumer preferences in wine selection and the criteria that influence consumers' purchasing decisions.

The study by Lutskova, Martirosyan and Krupytska (2020), published in the Ukrainian Journal of Food Science, focussed on identifying consumer preferences when choosing a bottle of wine using a questionnaire.In order to determine consumer preferences when choosing a bottle of wine, a questionnaire was created that was conditionally divided into two parts: questions about the respondent's gender, age, marital status and salary, and a direct question about the choice of a bottle of wine with possible answers. The factors influencing the consumer's choice when buying wine, as well as the offered reasons for buying wine and the general places of buying wine were proposed in the questionnaire for answering. The second part of the survey consisted of questions relating to the design, appearance of the label and the shape of the wine bottle. According to the results, consumers perceive the wine and its packaging as a single entity, as the appearance of the packaging plays an extremely important role in the consumer's belief process. The authors state that special attention should be paid to researching elements such as the design and labelling of wine, as they persuade an undecided consumer to purchase the product.

Tiziana de-Magistris, Azucena Gracia and Luis-Miguel Albisu (2014) in their study analysed the preferences of Spanish consumers when selecting premium red wines. Using a BWS approach, the researchers surveyed participants in Spain and presented them with a range of nine different premium red wine options, each differing in certain characteristics. The participants were given clear instructions about the aim of the study and how they have to behave when making their choices. As well as rating the wines, participants were also asked about their wine knowledge, their general attitude to wine and their willingness to buy premium products. The results showed that the most influential factor in wine selection was how well the wine matched the food. Other positively perceived attributes were the vintage of the wine, recommendations from others and price, although these were considered less important than food pairing. Conversely, attributes such as the brand name and the fact that you have read about the wine were not statistically significant, suggesting that consumers view them neutrally. Interestingly, the design of the wine label proved to be the least important attribute, with a statistically significant negative influence on consumer preference.

The authors Naomi Verdonk, Renata Ristic, Julie Culbert, Karma Pearce and Kerry Wilkinson (2020) conducted a study in Australia to investigate Australian wine consumers' perceptions and preferences towards different types of sparkling wine, including French Champagne, Australian white, red and rosé sparkling wine, Moscato and Prosecco. In an online survey of 1027 regular sparkling wine consumers, demographic data, perceptions and preferences for sparkling wines and typical consumption patterns were analysed. The consumers were categorised into 3 different groups: “No Frills”, “Aspirants” and “Enthusiasts" using the “Fine Wine Instrument” model. The “No Frills” offer only the bare essentials, nothing fancy, complex or luxurious. The “Aspirants” are a class of consumers who are neither poor nor middle class. Enthusiasts are willing to learn more about the details of a product than the average consumer who simply wants to use it. The majority of “No Frills” consumers were female and typically drank sparkling wine once a month. Almost 55% of “Aspirants” were male and had a household income of more than AUD$75,000. “Enthusiastic” consumers were also predominantly male and well educated, with 64% under the age of 35. White sparkling wine and Champagne were generally the most popular varieties for each consumer group, followed by Moscato and rosé sparkling wine. Moscato performed well in both the simple wine and enthusiast segments. Almost 25% of respondents said they did not know Prosecco, while sparkling wine and red wine were recognised equally by male and female consumers. The results of this study can help sparkling wine producers to better target their products and marketing strategies to the specific needs and expectations of consumers in the different segments of the Australian market.

The preferences of Croatian wine consumers may vary depending on the region, socio-demographic characteristics, cultural influences and trends in the world of wine. The influence of socio-demographic characteristics on the frequency of wine consumption has been the subject of numerous scientific studies. Stockley et al. (2017) conducted an empirical analysis of the effects of age on wine consumption behaviour in Australia and found a statistically significant difference between age groups – with older respondents having a higher frequency of consumption, while the 25-34 age group had a higher average consumption per consumption. The influence of income on consumer preferences is also frequently the subject of studies, with authors coming to contradictory conclusions. Garcia-Cortijo et al. (2019) came to the conclusion that higher income leads to higher wine consumption, while Dubois et al. (2021) find no significant influence of income level on consumption.

The Croatian authors focus mainly on how demographic factors influence wine selection. In their study, Katunar et al. (2024) attempt to identify factors that influence consumer preferences and their recognition of wine based on 169 surveys conducted. According to their findings, age, education, relationship status, household income and frequency of consumption influence the perception of recognising the quality of wine. Alpeza, Nižić and Lukač (2023) examine the habits of Croatian wine consumers and the importance of price, country of origin, grape variety, sugar content, colour, brand, bottle/label design depending on age, gender and subjective knowledge. According to some of their findings, most respondents perceive wine as a pleasure, consumers with more subjective knowledge experience wine as a product with potential health benefits, the frequency of consumption and the importance of the region of origin increases with age. Dlačić and Kadić-Maglajlić (2013) analysed how different factors influence the wine consumption of young generations in south-eastern countries (Bosnia-Herzegovina and Croatia) on different occasions of wine consumption. Their findings show that self-expression, socialising, tradition and food are significant predictors of wine consumption. According to a survey conducted in November 2021 by Blue Rock Consulting and the Improve agency, 80% of wine consumers in Croatia prefer wines of Croatian origin.
The survey was conducted via online poll in which 328 people aged 18 to 75, from all regions of Croatia, took part. Among the respondents, 218 of them drink wine at least once a month. In

order to better understand the preferences and habits of wine consumers in Croatia, the questions are mainly related to frequency of drinking wine, which varieties they like best, whether they prefer Croatian or foreign wines and how often they buy wine and in what price range. These and many other economic analyses provide an in-depth understanding of the wine market, enabling decision makers and businesses to make informed decisions and develop strategies for success in the market.

The criteria for this research were selected on the basis of previous studies and personal preferences as fundamental characteristics of wine. According to Zeithaml (1988), quality as the first factor in purchasing represents the overall result of experiences and various influences that affect the buyer, who uses this as a basis for assessing the competitiveness of the quality of the product/brand. Radovanović et al. (2017) state that of all the factors analysed in relation to consumer behaviour and preferences, the identified demographic factors dominate: age, region, family size and place of residence, social factors: education and income, and behavioural factors: importance of price, place of purchase and product characteristics. In The study by Radman et al. (2004), the name of the manufacturer or brand, the shape of the bottle or label, the type of production, price, age and the importance of intrinsic characteristics were mentioned: colour, taste and aroma were mentioned as the most important factors of the wine. In this paper, as well as in the paper entitled "The AHP quantification of student population attitudes in wine purchasing" by Jalić, Ostojić and Vaško (2022), wine quality is understood to mean the following: aroma, acidity, sugar content, alcohol content, vintage and geographical indication. Another group of factors that influence the purchase of wine and consumer attitudes towards buying this product is called "market characteristics" and includes price (Jalić, Ostojić and Vaško, 2022). Mentioned authors also used the criteria of availability, popularity and packaging as market characteristics in their study, which was not used in this paper. The results of this study show that wine quality is a much more important factor for the student population than market characteristics and that it has a major influence on purchase. Colour and packaging were ranked as the least important factors. Price and availability have the same influence on purchase, and alcohol content and vintage have the least influence. The flavour of the wine is the most important criterion when buying wine.

In order to conduct a multi-criteria analysis in this study, based on previous research (Jalić, Ostojić and Vaško, 2022), it was determined that quality attributes are the most important when analysing consumer preferences. The seventh criterion, price, was added in the research as the most important market attribute, which, like the quality attributes, has the greatest influence on consumer preferences, attitudes and willingness to buy (Radman, 2004; de-Magistris, Gracia and Albisu 2014).

3. Methodology

The Analytical Hierarchy Process (AHP) is a multi-attribute decision method that enables a combination of quantitative and qualitative criteria. According to Mardani et al., the AHP is the method most commonly used in multi-criteria decision making (Mardani et al. 2015.). AHP aims to integrate different measures into a single overall priority vector that represents the final score for ranking the decision alternatives. To create an overall priority vector, the individual pairs of criteria must be compared with each other and then the alternatives in relation to the individual criteria. Once this is done, a priority matrix can be created and normalised to calculate the overall priority vector. The AHP method has the advantage of highlighting the key features, strengths and weaknesses of each alternative. This mathematical method is the key to

selecting the most important criteria and ranks them in order of importance. The AHP method prioritises by comparing each alternative/criterion with all other alternatives/criteria, i.e. making relative comparisons between them using the Saaty scale. The following section explains the mathematical model of the AHP, in particular the calculation of the weights, starting with the pairwise comparison technique and ending with the consistency check. When determining the weights, each criterion is assigned a numerical value that indicates the degree of importance of the respective criterion. The AHP provides an answer to the question of whether one criterion is preferable to another and, if so, to what extent. To avoid subjectivity, the qualitative comparison must be carried out by an expert (or group of experts) familiar with the topic, or alternatively a survey can be conducted. In the present study, we opted for the latter. We asked respondents to express their personal opinions and categorise their answers using a scale developed by Thomas L. Saaty 2008. The method used can be explained in three basic steps derived from the seven pillars of Saaty's AHP (2012.). First, a decision matrix is created for the pairwise comparison according to the following formula:

$$A = [a_{im}] = \begin{bmatrix} 1 & \dots & a_{1n} \\ \dots & \dots & \dots \\ \frac{1}{a_{1n}} & \dots & 1 \end{bmatrix}, for\ i,m = 1,2,3\dots,n$$

where A_1, A_2,...,A_n denote the set of elements, while aim represents a quantified judgement on a pair of elements, A_i and A_m. In order to make comparisons between the criteria and between the alternatives in terms of the criterion or property by which they are compared, a numerical scale is needed. To this end, Saaty developed a measurement scale for pairwise comparison, which was used in the present study (Table 1).

Table 1: Saaty's scale

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Moderate importance	Experience and judgement slightly favour one activity over another
5	Strong importance	Experience and judgement strongly favour one activity over another
7	Very strong importance	An activity is favoured over another
9	Extreme importance	The evidence favouring one activity over another is over highest possible order of affirmation
2,4,6,8	intermediate values	Intensities between 1,3,5,7,9
Reciprocals of above	If activity I has one of the above non zero numbers assigned to it when compared to activity j, then activity j has reciprocal value when compared with i	

Source: Saaty, 2008

Verbal judgements are expressed by the degree of preference, and this degree is associated with a certain intensity of importance. Second, the decision matrix is normalised by adding up all sets of the individual column values. Each of these values is divided by the sum of its respective column. Finally, the row average and the weights assigned to the decision maker's objectives are calculated to obtain a set of n numerical weights $w_1, w_2, ..., w_i$. Thirdly, the eigenvalue is calculated and a consistency analysis is performed:

$$Aw_i = \lambda_{\max} w_i \text{ , for } i=1,2,3,...,n$$

Where $\lambda_{\max}$ represents characteristic value. After analysis the consistency ratio (CR) is calculated as fraction between consistency index (CI) and random index (RI) that is given by:

$$CR = \frac{CI}{CR}$$

The random index represents the consistency index that results from randomly generated pairwise comparison matrices of the range n. The value of the random index depends on the matrix range. The random values are given in Table 2.

Table 2: Random values

N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0.00	0.00	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49	1.51	1.54	1.56	1.57	1.58

Source: Authors

Any pairwise comparison for which the consistency coefficient is less than 0.1 can be considered valid.

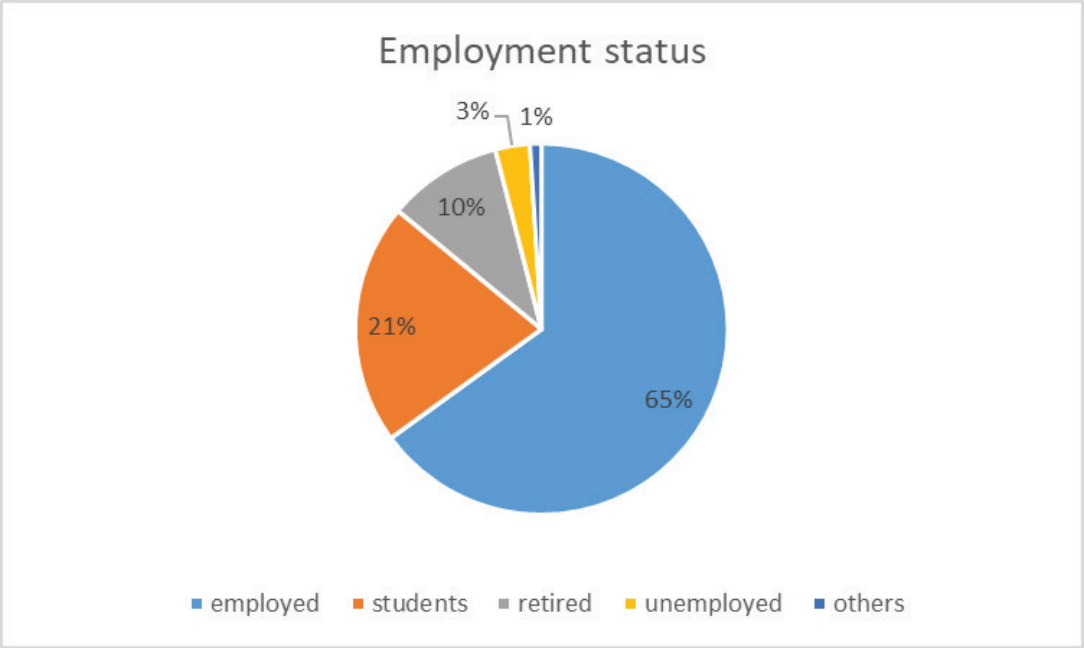
4. Analysis

The multi-criteria analysis was conducted on the basis of a questionnaire distributed to 155 respondents, whose answers were anonymous. The respondents were of different ages and genders and the questionnaire consisted of 4 parts. The first part contained general questions about the respondents, such as: Age, gender, education level, employment status, country of origin, number of household members, household income level. The second part of the questionnaire related to general questions about wine, which were selected for the questionnaires according to the factors influencing consumers, mentioned in the literature review, namely: how often do you consume wine, where do you prefer to buy wine, how much money are you willing to spend on a bottle of wine, do you prefer domestic or foreign wines and depending on your personal preference, you were asked to answer the statement "the combination of food and wine is important to me" with "strongly disagree", "disagree", "neither agree nor disagree", "agree" or "strongly agree". In the third part of the questionnaire, respondents were asked to rate the criteria offered on a scale of 1-5 in terms of their importance when buying wine. Finally, in the fourth part, respondents answered questions about which wine they prefer based on colour. When they clicked on white wine, the questionnaire redirected them to the white wine section, where the respondents rated the types of wine on offer on a scale of 1-5 based on the selected criteria: Sugar content (sweetness of the wine), price, acidity, alcohol content, vintage, geographical indication, aroma. When respondents clicked on red wine, the questionnaire redirected them to the red wine section, where respondents rated the types of red wine on offer on a scale of 1-5 based on the criteria mentioned. The multi-criteria

Analytical Hierarchy Process method was used for the analysis, while the Saaty scale, which is also used in this method, was used to express consumer preferences. Various criteria were adopted from previous studies (Jalić, Ostojić and Vaško, 2022; Radman, 2004; de-Magistris, Gracia and Albisu 2014) and new questions on the characteristics of wine were created based on these, which were evaluated using the values of the Saaty scale. For the purposes of the study, the Saaty scale was reduced to 5 main intensities of importance (Table 1). Finally, if respondents answered that they preferred rose, the questionnaire redirected them to the end of the survey. The AHP method was first conducted for the white wine category data and then for the red wine categories and is presented later in this article. The first part of the survey is analysed below.

In the research, 155 people took part in the survey, 67% of whom were women and 33% men. The basic statistics of the respondents show that 30% of the respondents were between 18 and 25 years old, 29% between 26 and 35 years old, 17% between 36 and 45 years old, 12% between 46 and 55 years old, 6% between 56 and 65 years old and 6% 66 years and older. In terms of education, 44% of respondents had a secondary school degree, 27% had a university degree, 24% had a university degree or higher and 5% had a lower level of education.

Figure 2: Graphical representation of employment status



Source: Authors

Of the 155 respondents, 65% are employed, 21% are students, 10% are retired, 3% are unemployed and 1% are other people. Most of the respondents come from Primorje-Gorski Kotar County, followed by Karlovac County, Istria, Bjelovar-Bilogora, Zagreb County, Brod-Posavina, Zadar County, etc. There were no respondents from Split-Dalmatia County, Virovitica-Podravina County and Požega-Slavonia County. When asked how often they consume wine, the respondents answered as follows: 29% of respondents consume wine only on special occasions, 26% of respondents consume wine weekly, 14% of respondents drink wine monthly, 23% of respondents do not drink wine, while 8% of respondents drink wine daily. When asked where they buy wine, 36% of respondents answered that they buy wine directly from the producer, 29% in a supermarket, 11% of respondents do not buy wine, 10%

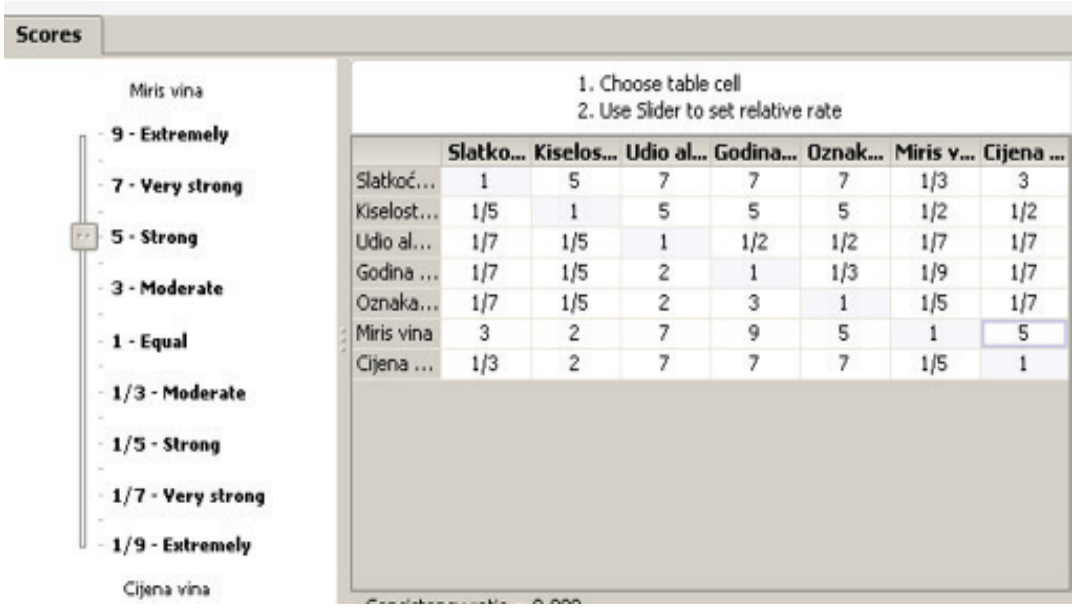
of respondents buy wine in a hypermarket, 7% of respondents buy wine in a wine bar or elsewhere. The majority of respondents are willing to pay 11-15 euros for a bottle of wine, while only 19% are willing to pay more than that. It is also important to note that 95% of respondents prefer domestic wines over foreign wines, while 62% of them opt for white wine.

4.1. Multi-criteria analysis of white wine varieties

We have already mentioned that 155 people took part in the survey, 67% of whom were women and 33% men. The study was conducted using a questionnaire distributed through social networks, which ensured the representativeness of the sample so as enabling a diverse respondent group and achieving both the desired sample size and structure. Respondents were asked to compare 5 white wine varieties and 5 red wine varieties based on the selected criteria, namely: Chardonnay, Rajnski rizling, Muškat Ottonel, Graševina bijela, Sauvingnon bijeli for white wines and Plavac mali, Cabernet Sauvignon, Frankovka crna, Merlot crni, Teran crni for red wines.

Based on the data from the second part of the questionnaire on the red and white wines and taking into account the selected criteria, pairwise comparisons were made. This resulted in the following comparison table for the comparison of the criteria, according to which the most important criterion in the opinion of the respondents was aroma, then sweetness and only then price (Figure 3)

Figure 3: Pairwise comparison of selected criteria



	Slatko...	Kiselos...	Udio al...	Godina...	Oznak...	Miris v...	Cijena ...
Slatkoć...	1	5	7	7	7	1/3	3
Kiselost...	1/5	1	5	5	5	1/2	1/2
Udio al...	1/7	1/5	1	1/2	1/2	1/7	1/7
Godina ...	1/7	1/5	2	1	1/3	1/9	1/7
Oznaka...	1/7	1/5	2	3	1	1/5	1/7
Miris vina	3	2	7	9	5	1	5
Cijena ...	1/3	2	7	7	7	1/5	1

Source: Authors

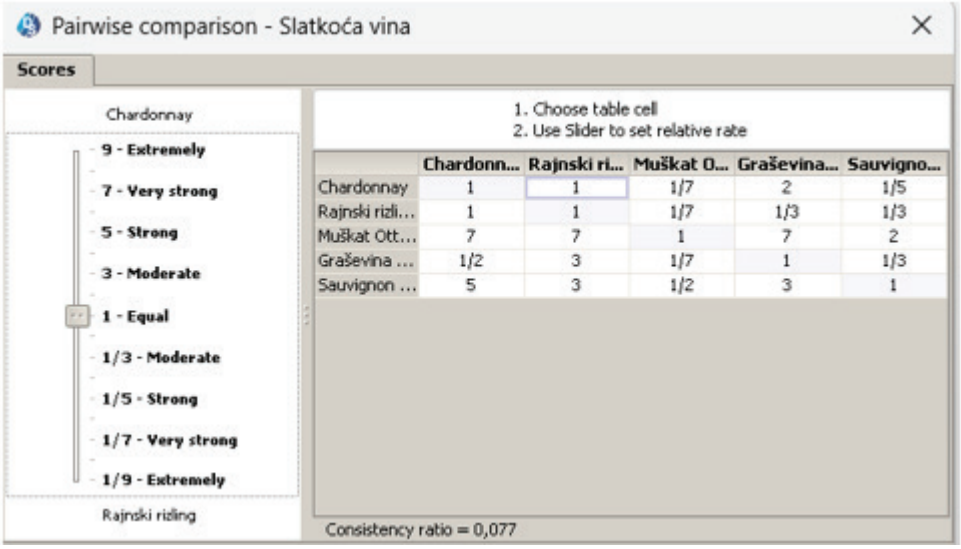
When assigning the criteria, the consistency coefficient was below 0.1 and the comparison is considered valid.

The next step in applying the AHP method relates to the comparison of the alternatives with regard to the individual criteria. The numerical values are entered in the table. The alternatives are compared according to all criteria and the values are taken from the second part of the questionnaire. The second part of the questionnaire contains an independent ranking of the

alternatives in relation to the selected criteria according to their importance in the range from 1 to 5. As the study mainly comprises white and mainly black wine varieties, the white and then the black wine varieties are analysed below.

Figure 4 shows a comparison of the alternatives according to the criterion of wine sweetness. After comparing the alternatives in terms of wine sweetness, Muscat Ottonel has the greatest advantage over the other alternatives, and Rajnski Riesling and Graševina have the lowest value. The consistency coefficient is 0.077, which means that the permissible consistency coefficient of 0.1 is not exceeded and the comparison is valid.

Figure 4: Pairwise comparison of white wine varieties with respect to sweetness criterion



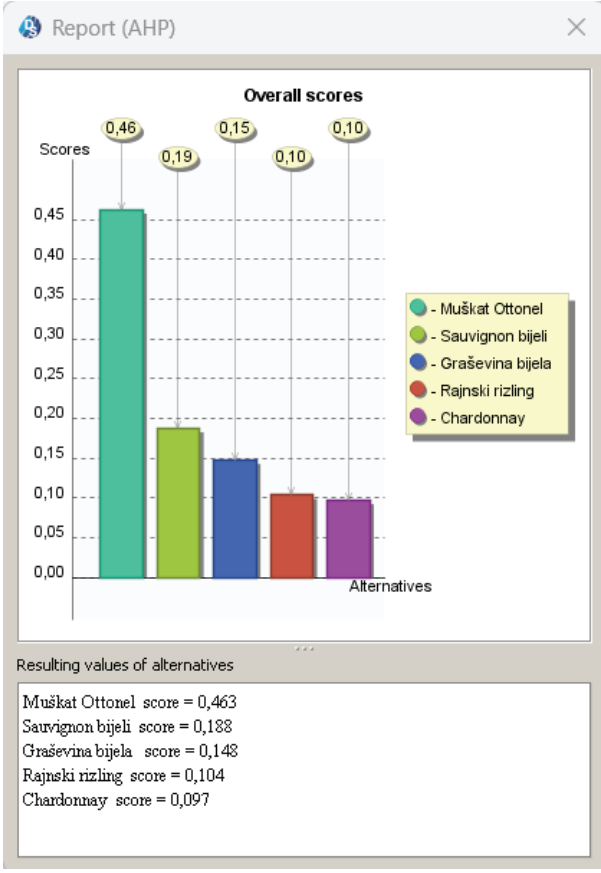
	Chardonn...	Rajnski ri...	Muškat O...	Graševina...	Sauvigno...
Chardonnay	1	1	1/7	2	1/5
Rajnski rizli...	1	1	1/7	1/3	1/3
Muškat Ott...	7	7	1	7	2
Graševina ...	1/2	3	1/7	1	1/3
Sauvignon ...	5	3	1/2	3	1

Source: Authors

In the next step, the wines were also compared according to other criteria. According to the acidity criterion, Graševina has the greatest advantage over the other alternatives, while Muscat Ottonel has the least advantage. According to the alcohol content criterion, Graševina has the greatest advantage over the other alternatives, while Muscat Ottonel has the least advantage. When comparing the alternatives according to the wine aroma criterion, shows that Muscat Ottonel has the highest value, while Graševina white has the lowest value. The last comparison of the alternatives for the white wine category refers to the comparison according to the wine price criterion. Muscat Ottonel has the greatest advantage over all alternatives, while Rhine Riesling has the lowest. In all comparisons, the condition that the consistency coefficient CR<0.1 was met and the comparisons were valid.

In the following, the overall priority for each white wine variety included in the analysis was calculated taking into account all criteria and their initial weighting, leading to the result shown in Figure 5.

Figure 5: Overall priorities for white wine varieties



Source: Authors

Figure 5 shows the final ranking of the alternatives. According to this we conclude that consumers in the Republic of Croatia, according to our findings, prefer white wine from the Muscat Ottonel variety the most (0.463) and Chardonnay the least (0.097). The fact that Muscat is the best white wine is also confirmed by the fact that Muscat wines are known for their intense aroma containing notes of flowers, citrus, honey, apricot and nutmeg, which attracts many consumers who like complex and fragrant wines. They are also produced in different styles, such as dry, semi-dry, sweet and sparkling, so consumers can find a Muscat to suit their tastes and different occasions. Muscat wines also have low to moderate acidity and lower alcohol content, making them light and approachable. Consumers appreciate the drinkability and the ability to enjoy the wine without too much complexity. Muscat wines pair well with a variety of foods, such as fruit desserts, light dishes, Asian cuisine and cheese. This makes Muscat an ideal wine for a variety of gastronomic combinations. In terms of availability, Muscat wines are widely available and also more affordable compared to some other popular white wines, making them an affordable choice for a wide range of consumers. Muscat wines combine the long traditions of many wine regions such as Italy, France, Spain and Croatia. The regional styles give them uniqueness and historical value, which is also attractive to consumers who value authenticity and tradition.

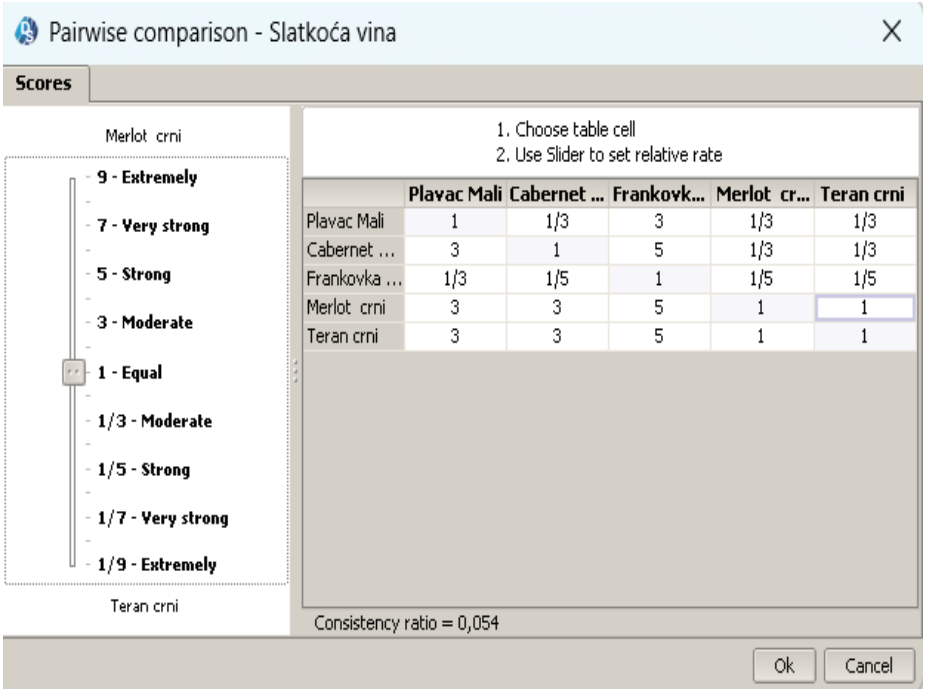
Since Muscat wine is mainly produced in Istria and a larger number of respondents are women from the Croatian coastal area, Muscat stands out as a wine that will be popular with this population and is most often offered in restaurants and cafés. It should also be mentioned that Muscat wine is very popular among the female population due to its sweet and light taste.

4.2. Multi-criteria analysis of red wine varieties

Below you will find a comparison of the red wine alternatives in relation to all selected criteria as well as for white wines.

According to the sweetness criterion, the highest value is for Merlot red and Teran red and the lowest for Frankovka red. The consistency ratio is 0.054, which means that the condition of consistency ratio < 0.10 is met and the pairwise comparison is valid. All this is shown in Figure 6.

Figure 6: Pairwise comparison of black wine varieties with respect to sweetness criterion



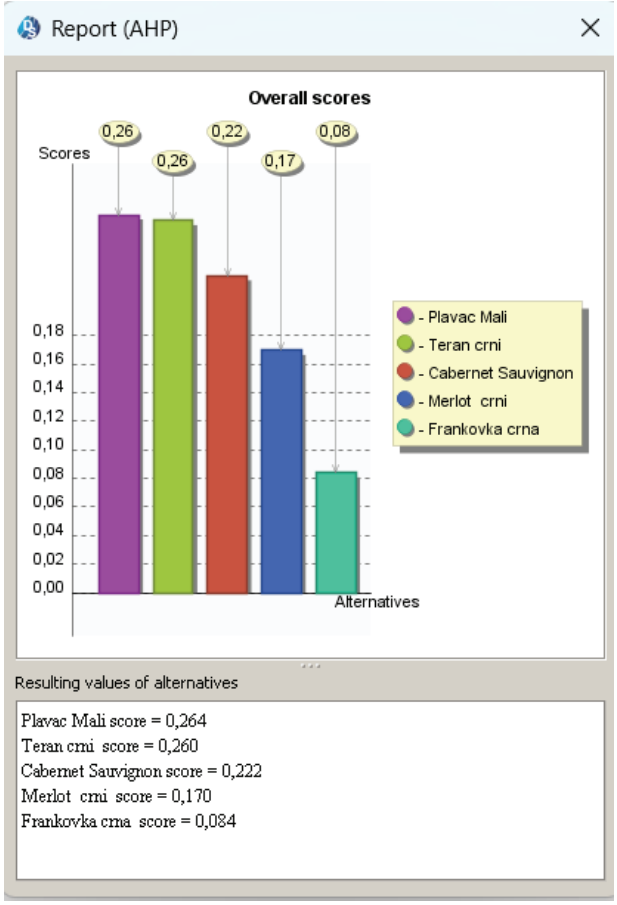
	Plavac Mali	Cabernet ...	Frankovk...	Merlot cr...	Teran crni
Plavac Mali	1	1/3	3	1/3	1/3
Cabernet ...	3	1	5	1/3	1/3
Frankovka ...	1/3	1/5	1	1/5	1/5
Merlot crni	3	3	5	1	1
Teran crni	3	3	5	1	1

Source: Authors

The comparisons of the red wine varieties according to other criteria were approached in the same way, taking into account the results obtained. Thus, when comparing the alternatives according to the tartaric acid criterion, the highest value was assigned to Frankovka Crna and the lowest to Teran Crni. In the following comparison of wines according to the alcohol content criterion, the highest value was assigned to Plavac Mali and the lowest to Frankovka Crna. When comparing the alternatives according to the vintage criterion, the highest value was assigned to Teran Crni and the lowest to Frankovka Crna. When comparing the alternatives according to the criterion of geographical origin, the highest value was assigned to Teran Crni and the lowest to Cabernet Sauvignon, while when comparing the alternatives according to the criterion of wine aroma, the highest value was assigned to Plavac Mali and the lowest to Frankovka Crna. When comparing the alternatives according to the criterion of wine price, the highest value was assigned to Cabernet Sauvignon and the lowest to Frankovka Crna. In all comparisons, the consistency coefficient was CR<0.1, and all comparisons are considered valid.

After all alternative comparisons were completed, the overall priority for each red wine variety was calculated and the result is shown in Figure 7.

Figure 7: Overall priorities for red wine varieties



Source: Authors

Figure 7 shows the final ranking of the red wine varieties. According to the report, we conclude that Croatian consumers, according to our findings, prefer red wine of the Plavac Mali variety the most (0.264), slightly followed by Teran Crni, while they prefer Frankovka Crna the least (0.084). Plavac Mali is a wine characterised by rich aromas of dark fruits such as plums and cherries. Its full flavour makes it very attractive to consumers, including the respondents to this survey, most of whom come from Primorje-Gorski Kotar County. Although Plavac Mali is grown in certain areas of Dalmatia, it is attractive to consumers of wine from Primorje-Gorski Kotar County. Plavac Mali has a long tradition in Croatia, which evokes a sense of attachment and pride among consumers who appreciate local products with a rich history. Plavac Mali is also versatile and goes well with various dishes, so consumers can find it in all restaurants and cafés. The wine is accessible to a wider audience due to its quality and wide price range from affordable to premium wines.

The sensitivity analysis has shown that the ranking of the wine types is stable across all criteria and that small changes in the preferences of the criteria have little or no influence on their ranking. In the event of major changes in the weighting of the selected criteria, the ranking of the white wine varieties would only change if the weighting of the acidity criterion were to increase significantly (above 0.4). In this case, Graševina would take first place and Muscat would fall to second place, while the other wine varieties would not be affected. The same applies to flavour, where a significant increase in weight would change the positions of Graševina, which would fall in the ranking, and Rhine Riesling and Chardonnay, which would all rise in the ranking. In contrast to the white varieties, the red varieties are also robust in the

sensitivity analysis, but they react to the sweetness criterion. If the weighting of this criterion were increased significantly (above 0.4), Merlot Crni and Teran Crni would rise in the ranking and Plavac would fall, while the ranking of the red wine varieties would not change for the other criteria

5. Conclusion

The agricultural sector in Croatia is facing numerous challenges resulting from the lack of competitiveness of producers, problems with distribution and supply chains and a shortage of labour. Given the current geopolitical challenges, agriculture is becoming a matter of national interest, and without secure agricultural production there is no self-sustainability. The above reasons led to this research with the aim of improving the competitiveness of Croatian wine producers.

The aim and purpose of this study is to demonstrate the importance of selected criteria for Croatian consumers when buying wine and to show which criteria influence consumers' decisions. For the purpose of this study a survey was conducted among 155 respondents from all over Croatia who are older than 18 years. The results were analysed using the multi-criteria decision making method, more specifically the Analytical Hierarchy Process method. The article presents both the application of the method itself and the analysis procedures. If the weightings of the criteria are distributed differently, the overall prioritisation of the red wines, where the difference between the first and second wine is negligible, could turn out differently and influence the overall ranking of the red wine varieties. The research results show that a regular Croatian wine consumer is on average between 36 and 45 years old, highly educated and lives in a family with a monthly income of up to 4,000 euros. In terms of purchasing habits, respondents stated that they usually buy wine directly from the producer. This behaviour indicates that consumers prefer local food that is characterised by a high social benefit on the one hand and are willing to support the economic growth of the local community on the other. In addition, the study found that consumers spend around €10 per bottle of wine and that they consume wine in a social context, such as family gatherings, dinners with friends or celebrations.

The study also shows that consumers prefer domestic wines the most. In terms of wine characteristics, consumers prefer white, semi-sweet and semi-dry wines. According to the results of the study, when choosing wine Croatian consumers place the greatest value on the market characteristics of the wine, such as price and quality characteristics, i.e. sweetness and aroma of the wine. Characteristics such as geographical indication and vintage are considered less important. In terms of consumer preferences, i.e. the choice between the best white and red wine, Muscat Ottonel comes first for the choice of white wine and Plavac Mali for the choice of red wine. In this study the results show that Croatian consumers attach greater importance to the quality of the wine than to market characteristics such as price, and it is assumed that this has a major influence on the purchase. Each of the criteria has its advantages, and individual preferences play a major role in the decision-making process. As far as the method itself is concerned, the analytical hierarchy process can become complex and time-consuming for larger problems with many criteria and alternatives. The sensitivity analysis in this study has shown that the ranking of the wine types is stable across all criteria and that small changes in the preferences of the criteria have little or no influence on their ranking.

The results of the analysis can depend on the subjective judgements of the respondents, which can influence the results. Another disadvantage is that the process of comparing pairs can be tedious and error-prone, especially with a large number of criteria and alternatives, but this consistency is controlled using the consistency coefficient. If respondents are not consistent in their comparisons, the results of a consistency check may also be unreliable. In addition to the disadvantages, the method also has its advantages. It enables a structured and clear approach to complex problems by breaking them down into hierarchical structures, which also facilitates understanding and analysis. It can also be used for different quantitative or qualitative types of problems and combine different measurement units and data types. The method enables the quantification of respondents' subjective criteria and preferences by converting them into numerical values that can be analysed. The decision-making process is transparent, making it easier to track and understand the reasons for a particular decision.

The limitations of this study lie in the small sample of 155 respondents. Although the questionnaire was distributed via social media, which ensured the representativeness of the sample, the authors suggest increasing the sample to at least 350 respondents for future research. A larger sample would also likely have an equal proportion of men and women, which is another limitation of this study. In the study conducted, the results could be considered biassed due to the higher proportion of women completing the questionnaire, which affects the final ranking results.

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REFERENCES

Alpeza, I., Nižić, I., & Lukač, Z. (2023): ***What influences Croatian consumers' wine choice?*** Tržište: časopis za tržišnu teoriju i praksu, *35*(1), 41–56. https://doi.org/10.22598/mt/2023.35.1.41

Charters, S., & Pettigrew, S. (2007): ***The dimensions of wine quality***. Food Quality and Preference, *18*(7), 997–1007. https://doi.org/10.1016/j.foodqual.2007.04.003

Croatian Bureau of Statistics, https://dzs.gov.hr/

de-Magistris, T., Gracia, A., & Albisu, L. M. (2014): ***Examining Spanish consumers' preferences for premium red wine attributes using best–worst scaling***. Spanish Journal of Agricultural Research, 12(3), 529–541. https://doi.org/10.5424/sjar/2014123-5107

Dlačić, J. & Kadić-Maglajlić, S. (2013): ***The role of gender and situational factors in wine consumption of generation Y***. South East European Journal of Economics and Business (SEEJ), 8(1), 48-56. https://doi.org/10.2478/jeb-2013-0008

Dubois, M., Agnoli, L., Cardebat, J., Compes, R., Faye, B., Frick, B., Gaeta, D., Giraud-Heraud, E., Le Fur, E., Livat, F. (2021): ***Did Wine Consumption Change During the COVID-19 Lockdown in France, Italy, Spain, and Portugal?***, Journal of Wine Economics, 16(2), 131-168. https://doi.org/10.1017/jwe.2021.19

Garcia-Cortijo, M. C., Villanueva, E. C., Castillo-Valero, J. S., Li, Y. (2019): ***Wine consumption in China: Profiling the 21st century Chinese wine consumers***, Ciencia e Tecnica Vitivinicola, 34(2), 71-83. https://doi.org/10.1051/ctv/20193402071

Jalić, N., Ostojić, A., & Vaško, Ž. (2022): ***The AHP quantification of student population attitudes in wine purchasing***. Agriculture and Forestry, 68(1), 207–217. https://doi.org/10.17707/AgricultForest.68.1.13

Katunar, J., Vretenar, N., Filipas, A. M., Jardas Antonić, J., & Prudky, I. (2024): ***Recognising wine quality – Examining demographic influences and consumer preferences***. Zbornik Veleučilišta u Rijeci, *12*(1), 301–320. https://hrcak.srce.hr/clanak/458965

Kaštelan Mrak, M., Kaštelan, K. (2023): ***Iskustvena dobra – implikacije sagledavanja vina kao iskustvenog dobra***, Izazovi vinskog sektora u Republici Hrvatskoj, Katunar, J. & Vretenar, N. (Eds), Sveučilište u Rijeci, 101-113.

Kovačić, D., Šantalab, A., & Mesić, Ž. (2021): *Poznatost i zadovoljstvo potrošača vinima hrvatskih autohtonih sorti*. U V. Rozman & Z. Antunović (Ur.), 56. hrvatski i 16. međunarodni simpozij agronoma: zbornik sažetaka (str. 226-230). Osijek: Fakultet agrobiotehničkih znanosti Osijek.

Lutskova, V., Martirosyan, I., & Krupytska, L. (2020): ***Analysis of consumer preferences when choosing wine.*** Ukrainian Journal of Food Science, 8(1), 159–168. https://doi.org/10.24263/2310-1008-2020-8-1-15

Mardani A. et al. (2015): ***Multiple criteria decision-making tech niques and their applications – A review of the literature from 2000 to 2014***. Economic Research 28(1), 516-571. DOI: 10.1080/1331677X.2015.1075139

Moralić, S., & Pandža Bajs, I. (2014): ***Analiza obilježja hrvatskih potrošača generacije Y u potrošnji vina.*** Zbornik Ekonomskog fakulteta u Zagrebu, 12(2), 1-16. Preuzeto s https://hrcak.srce.hr/132979

Radman, M., Kovačić, D., & Gašparec-Skočić, L. (2004): Wine perception and consumption among young adults in Croatia. U *XXVIII. World Congress of Vine and Wine, Book of Abstracts* (str. 137). Beč: Organisation Internationale de la Vigne et du Vin., Wine perception and consumption among young adults in Croatia

Radovanović, V., Đorđević, D. Ž., & Petrović, J. (2017): ***Wine marketing: Impact of demographic factors of Serbian consumers on the choice of wine***. Economic Themes*,* 55*(2)*, 199–215. https://doi.org/10.1515/ethemes-2017-0012

Saaty T.L. (2008): ***Decision making with the analytic hie rarchy process***. International Journal of Services Sciences 1(1), 83-98. 10. Saaty T.L., Vargas L.G. (2012). Models, methods, concepts & applications of the analytic hierarchy process. Boston, MA: Springer.

Saaty T.L., Vargas L.G. (2012): ***Models, methods, concepts & applications of the analytic hierarchy process***. Boston, MA: Springer.

Stockley, C. S., Taylor, A.W., Montgomerie, A., Dal Grande, E. (2017): ***Changes in wine consumption are influenced most by health: results from a population survey of South Australians in 2013***, International Journal of Wine Research, 9, 13-22. https://doi.org/10.2147/IJWR.S126417

Verdonk, N., Ristic, R., Culbert, J., Pearce, K., & Wilkinson, K. (2020): ***Understanding Australian Wine Consumers' Preferences for Different Sparkling Wine Styles***. Beverages, 6(1), 14. https://doi.org/10.3390/beverages6010014

von Wright, G. H. (1963): The Logic of Preference, Edinburgh: Edinburgh University Press

Vretenar, N., Katunar, J., & Zaninović, V. (2023): ***Determinante učestalosti konzumacije vina u Hrvatskoj.*** *Ekonomski vjesnik/Econviews* - Review of Contemporary Business, Entrepreneurship and Economic Issues, 36(2), 399–408. https://doi.org/10.51680/ev.36.2.14

Zeithaml, V. A. (1988): ***Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence***. Journal of Marketing, *52*(3), 2–22. https://doi.org/10.1177/002224298805200302

A scientific paper

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EMBRACING IMMERSIVE EXPERIENCES: EXPLORING USER ACCEPTANCE OF AUGMENTED REALITY AND VIRTUAL REALITY TECHNOLOGIES IN BOSNIA AND HERZEGOVINA

ABSTRACT

With the increasing prevalence of augmented and virtual reality (AR/VR) technologies in Bosnia and Herzegovina (BiH), understanding the readiness for their acceptance is crucial. This research aims to explore the readiness of individuals in BiH to adopt AR/VR technologies. Utilizing qualitative research techniques – focus groups with various participants, it sheds light on perceptions, understanding, and factors influencing the adoption of immersive AR/VR technologies among individuals in BiH. The findings reveal an awareness among individuals in BiH of the distinctive qualities of AR/VR. By highlighting the evolving landscape of AR/VR technologies in BiH, the study underscores the significance of understanding and leveraging new technologies for users and marketers. The insights provided aim to inform decision-making processes regarding the integration and use of AR/VR technologies in BiH, facilitating their broader acceptance and effective implementation.

Key words: *Immersive technologies, virtual reality (VR), augmented reality (AR), digital marketing, Bosnia and Herzegovina.*

1. Introduction

In the contemporary digital age, technology represents more than just a tool; it embodies a complex system born out of human inventiveness and expertise, aimed at achieving specific goals (Volti, 2014). The rapid evolution of technology profoundly impacts marketing systems, particularly in the realm of digital media technologies used for promotional and professional purposes. While an increase in market value is anticipated, questions arise regarding the future applications and broader implications of such technology (Chadha, 2019; Rolph, 2016). These modern technologies have fundamentally reshaped modern marketing practices, significantly influencing how companies communicate with their clients and promote their products (Breidbach & Maglio, 2016; Grewal et al., 2019; Pagani & Pardo, 2017). Digital technology plays an indispensable role in shaping consumer journeys (Dellaert, 2019; Hildebrand & Schlager, 2019; Novak & Hoffman, 2019), simultaneously impacting customer-centric strategies and brand-building efforts (Hamilton, 2016; Swaminathan et al., 2020).

The advancement of technology in the digital environment opens innovative opportunities for enterprises willing to invest in new technologies (Bonetti et al., 2022). As digital technologies progress, they become crucial for achieving strategic efficiency in marketing activities, making investments in digital technologies a necessary strategic endeavor (Georgiadis, 2022). Additionally, the emergence of Web 3.0 technologies and the development of the metaverse offer entirely new possibilities for creating alternative realities and engaging with consumers.

Marketers increasingly utilize virtual and augmented reality technologies to create immersive experiences for brands. These technologies profoundly change the way of communicating with consumers, while preserving the brand's identity and key messages. Digital marketing heavily relies on internet infrastructure and technology. Therefore, it is crucial to understand the potential innovations that can reshape the operational landscape of digital marketing (Shahab et al., 2021; Peštek & Čičić, 2010; Christensen, 1997). Disruptive innovations stemming from modern technologies such as machine learning, artificial intelligence, virtual, and augmented reality are expected to significantly impact digital marketing and business practices in general. As a result, companies are confronted with the need to swiftly make decisions and enhance their information and communication technologies. This places digital marketing at the forefront of their operations, influencing consumer perceptions.

In a world where technological advancement increasingly becomes an integral part of everyday life, augmented and virtual reality (AR/VR) technologies emerge as revolutionary tools that change the way we perceive and interact within the digital environment. Introducing these immersive technologies brings the potential for transforming various industries, including education, tourism, marketing, medicine, and many others. In Bosnia and Herzegovina, where the technological landscape is rapidly evolving, understanding the readiness for acceptance and adoption of AR/VR technologies becomes a critical issue for further progress and acceptance of technological innovations. Therefore, this paper explores the specific situation in BiH to uncover how individuals perceive, accept, and utilize AR/VR technologies and how their readiness for adoption can shape the future of these technologies. This analysis enables a better understanding of the needs and challenges associated with the integration of AR/VR technologies in BiH and provides guidelines for their successful introduction and implementation in various sectors of society.

2. Theoretical background

The concept of AR dates to the 1950s, but it was not popularized until Tom Caudell and David Mizell used the term in 1990 (Berryman, 2012). The definition of AR encompasses the integration of digital information with the real world in real-time (Azuma, 1997; Feiner et al., 1993; Milgram et al., 1995).

Numerous studies explore the application of AR in various fields, including technology development (Zhou et al., 2008), the impact on social interactions (Miller et al., 2019), tourism (Yin et al., 2021), marketing (Hoffman et al., 2022; Tan et al., 2021), service management (Heller et al., 2021), and more. Thanks to the advancement of mobile devices and overall technological progress, AR is becoming increasingly accessible to a wide range of users (Billinghurst et al., 2015).
This accessibility is changing consumer behavior patterns in purchasing and consuming products and services (Piancatelli et al., 2021; van Esch et al., 2019; Verhoef, 2021). Rauschnabel, Felix, and Hinsch (2019) had already emphasized that augmented reality would

play an increasingly important role in marketing strategies prediction that has been confirmed by subsequent studies. In this context, AR was described as a digital technology that merged computer-generated content, including images and sounds, with real-world data from the user's surroundings (Baek et al., 2018). Recent studies suggest that AR is rapidly becoming an integral part of marketing strategies across various industries. For instance, Kim et al. (2023) emphasizes the potential of AR to create compelling and personalized customer experiences, while Syed et al. (2022) highlights its capacity to allow consumers to visualize products in their own environment, interact with digital content in novel ways, and receive real-time feedback, all of which are transforming the traditional marketing landscape.

AR offers marketers the opportunity to blend experiences from offline and online realms, facilitating consumers in maintaining realistic expectations about products (Fan et al., 2020). Despite being a long-standing technology with fundamental principles spanning decades, research examining the acceptance and application of AR in business and marketing remains limited in Bosnia and Herzegovina.

Before AR gained prominence, there existed the concept of immersing users in an artificially constructed reality. While this idea traces back to early science fiction and fantasy literature, the initial iterations of "virtual reality" (VR) were panoramic images aimed at encompassing the viewer's field of vision, providing a sense of immersion in the depicted scene (Bown et al., 2017). Panoramic images employed perspective techniques to enhance the sense of presence, while stereoscopic viewers further developed this concept by providing a more realistic impression of being in the displayed environment.

The general use of technology like modern VR began with applications such as the Link Trainer, used for pilot training before and during World War II (Jeon, 2015). Modern virtual reality often employs head-mounted displays (HMDs) to immerse users in virtual environments, effectively isolating them from their physical surroundings.

Researchers have explored the potential of VR in sectors such as retail (Krasonikolakis et al., 2018), B2B marketing (Klico, 2022), fashion (Yaoyuneyong et al., 2018), manufacturing (Berg & Vance, 2017), tourism (Lee et al., 2020; Wei et al., 2019), healthcare (Fertleman et al., 2018), and as a research tool (Stadler at al., 2019). However, to fully harness their potential in enhancing consumer engagement and shaping future experiences, it is important to understand the various opportunities and applications of AR and VR.

It is important to investigate the acceptance of AR and VR technologies among consumers in Bosnia and Herzegovina to better understand their perception and readiness for the adoption of these innovations into daily life. Examining their attitudes, perceptions, and expectations can provide key insights into how these technologies can be successfully integrated into business models, marketing strategies, and user experiences. Additionally, understanding the barriers and limitations that may affect the adoption of these technologies in the local context will enable the adaptation of strategies and practices to maximize the benefits of AR and VR in Bosnia and Herzegovina.

Given the rapid evolution of technology, AR and VR promise revolutionary changes in how we interact with the digital world. In Bosnia and Herzegovina, these technologies can play a crucial role in the development of industry, tourism, education, and other sectors. Furthermore, further research into AR and VR in specific contexts in BiH, such as their application in education, cultural heritage, or industry, can reveal new ways to harness the potential of this technology

to improve quality of life and societal development. Considering the fast-changing technological landscape, it is essential to continuously explore and discuss the opportunities and challenges that AR and VR bring to maximize their advantages and minimize potential drawbacks. Such research can serve as a foundation for making informed decisions and shaping strategies for future use of these technologies in Bosnia and Herzegovina.

3. Research methodology

This paper is based on research into consumers' intentions to use innovations in the field of AR/VR in Bosnia and Herzegovina, conducted through focus groups. Using a qualitative research method, the study will explore consumers' readiness in Bosnia and Herzegovina to accept AR/VR technological innovations and the factors influencing this readiness. The aim is to identify key factors shaping consumers' intentions to use AR/VR technologies and provide insights that can inform marketing strategies and the implementation of AR/VR technologies in Bosnia and Herzegovina.

The main objective of the focus groups was to provide insights and perspectives on attitudes, opportunities, and challenges related to the use of AR/VR, as well as potential intentions for adopting these technologies.

The research interest was sparked by the clear potential of these technologies, which remains largely untapped as innovation continues to evolve, motivating us to explore:

1. How do consumers in Bosnia and Herzegovina first encounter augmented and virtual reality?
2. What are the factors influencing the acceptance of augmented and virtual reality among consumers in Bosnia and Herzegovina?
3. Is there readiness for the acceptance of virtual and augmented reality in Bosnia and Herzegovina?

Focus groups were conducted as the primary method of data collection for this study. These interviews yielded detailed insights and information, chosen for their suitability in exploring the nuances of the research topic, integrating diverse perspectives, elucidating processes, and deriving shared understandings (Weiss, 2014). The authors plan to conduct quantitative research, where the findings from the focus groups, together with relevant theoretical frameworks, will serve as the basis for designing a research instrument that is yet to be developed in the next phase of the study. Through this approach, the researchers gained a comprehensive understanding of consumer perceptions, identified key factors influencing technology adoption, and established a foundation for further exploration and recommendations regarding their marketing applications.

The study utilized a selective process for participant selection in focus groups, guided by predetermined criteria for homogeneity, such as familiarity with AR/VR terms, use of AR/VR applications, and age. Participation in the study was voluntary. Three focus groups were organized, each comprising a diverse population, with eight members in each group. The research was conducted in February 2024.

Table 1: Participant profile (coding)

Focus Group	*Men*	*Woman*
Group 1	M1, M2, M3, M4, M5	W1, W2, W3
Group 2	M6, M7, M8, M9	W4, W5, W6, W7
Group 3	M10, M11, M12, M13, M14	W8, W9, W10

Source: Authors

The initial focus group consisted of eight participants who had some familiarity with AR/VR terminologies but did not actively incorporate these technologies into their daily routines. This group represents an interesting demographic with awareness of the technologies, even though they were not fully integrated into their lifestyles. The second group comprised eight participants aged between 18 and 35, who were acquainted with AR/VR terms and utilized them in their everyday lives. The age cutoff at 35 years was chosen to differentiate between digitally native users, those who grew up with digital technologies—and older users who adopted such technologies later in life. This division is supported by literature suggesting that individuals under the age of 35 are generally more inclined to adopt emerging technologies such as AR/VR more quickly (Prensky, 2001; Klie, 2012). This segmentation enables a deeper understanding of generational differences in the perception and adoption of immersive technologies. This demographic represents an essential group that frequently explores novel technologies and innovations, and the objective of this group is to delve deeper into their attitudes, perceptions, and experiences concerning these technologies.

The third group assembled eight participants who were familiar with AR/VR terms and integrated them into their daily activities. Consisting of individuals over 36 years old, this group represents a mature demographic that has embraced and adapted to modern technologies in their lifestyles. This group offers valuable insights into how older adults adapt to AR/VR technologies and contributes to understanding the impact of these technologies on their lives and daily activities.

For the research purposes, a Semi-Structured Interview Protocol tailored to focus group participants was developed. This protocol was developed by the authors based on the works listed in the table below.

Table 2: Interview guidelines

Construct/Theme	Question/Item	References in literature
Initial Encounter with AR/VR Technologies	-How did you first come into contact with augmented reality and virtual reality technologies?	-
Perceived benefits/Performance expectancy	-How do you perceive the potential benefits of augmented reality and virtual reality technologies in your daily life, considering their potential to facilitate task completion, expedite processes, or enhance productivity, even if you currently do not use them? -How would you describe your perspective on how augmented reality and virtual reality technologies could enhance your daily life and assist you in completing tasks more efficiently, and do you believe their usage could increase your productivity? -Could you outline the benefits you observe in your everyday life by using augmented reality and virtual reality applications, particularly in terms of their utility in completing daily tasks and increasing productivity?	-Venkatesh et al. (2012) -Venkatesh et al. (2003)

Construct/Theme	Question/Item	References in literature
Ease of use/ Expected effort	-How would you rate the ease of using augmented and virtual reality technologies, even if you currently do not use them, considering the learning/familiarization process of using applications? -How would you assess the ease of use of augmented and virtual reality technologies, including the learning process of how to use them and interaction with them? -How would you describe your experience using augmented and virtual reality technologies in terms of ease of learning, interaction, and navigation, as well as the overall perceived ease of use, considering your experience?	-Venkatesh et al. (2012) -Venkatesh et al. (2003)
Social Influence	-How would you describe the influence of the opinions of significant individuals in your life on the potential use of augmented and virtual reality technologies, particularly considering the recommendations of people who matter to you and whose opinions you value? -How would you describe the impact of the attitudes and expectations of significant individuals in your life on your use of augmented and virtual reality technologies? -How would you characterize the influence of important individuals in your life on your decision to use augmented reality and virtual reality technologies, considering their opinions on the matter, as well as the influence of individuals who have a significant impact on your behavior and opinions that you value?	-Venkatesh et al. (2012) -Venkatesh et al. (2012)
Facilitating condition	-How would you describe your current capabilities and circumstances that could affect your readiness to use augmented and virtual reality technologies, including the availability of necessary hardware, compatibility with other technologies, and the possibility of receiving assistance from others if you encounter difficulties in using AR/VR technologies? -How would you describe your experience with the availability of necessary resources, compatibility with other technologies, and support from other users in using augmented and virtual reality technologies, considering that you already use AR/VR applications? -How would you describe your current capabilities and circumstances influencing your readiness to use augmented reality and virtual reality technologies, including the availability of necessary hardware, compatibility with other technologies you use, and the possibility of receiving assistance from others in case of difficulties using AR/VR technologies?	-Venkatesh et al. (2012) -Venkatesh et al. (2003)
Hedonic motivation	-How would you describe your emotional reactions and satisfaction you might experience when using augmented and virtual reality technologies, including the enjoyment, sense of satisfaction, and pleasure that such experiences would provide you? -How would you describe your subjective experience using augmented and virtual reality applications, considering the pleasure, entertainment, and relaxation they offer, and how do these experiences influence your motivation for further use of these technologies? -How would you describe the enjoyment and satisfaction you derive from using augmented and virtual reality technologies, and how do these experiences affect your motivation for further use of these technologies?	-Venkatesh et al. (2012) -Kim, Malhorta, Narasimhan (2005)
Price value	-How would you assess your opinion on the economic value of augmented and virtual reality technologies, including the perception of price, the price-quality ratio, and your overall opinion on the economic feasibility of investing in AR/VR technologies? -How would you describe your opinion on the price-value ratio of the AR/VR technologies you use, and how does that perception influence your decision to further use these technologies?	-Azzahra & Kusumawati (2023)

Construct/Theme	Question/Item	References in literature
	-How would you rate the price of AR/VR technologies and their relation to their usefulness and quality, and how do these ratings affect your motivation for further use?	
Habit	-How would you describe your perception of habit or need for using augmented and virtual reality technologies, considering your current situation (non-usage) and experience, and how would you describe your attitude towards potential future use of AR/VR technologies in your daily life? -How would you describe your attitude towards the use of AR/VR technologies, including your usage habits, dependency on these technologies, and perception of the necessity of their use in your daily life? -How would you describe your attitude towards the habit of using AR/VR technologies, including how often you use them, to what extent you feel dependent on them, and how necessary you consider their use in your daily life?	-Limayem & Hirt (2003)
Interactivity	-How would you describe your attitudes towards interactivity in augmented and virtual reality technologies, and how would you assess how those interactive features could meet your needs or assist in completing various tasks, even if you currently do not use AR/VR applications? -How would you describe your experience with the interactivity of AR/VR applications, including their ability to meet your demands and facilitate task completion? -How would you describe your experience with the interactivity of AR/VR applications? Do you consider the interactive features in those applications adequate and useful for performing your tasks?	-Batucan et al. (2022)
IT Innovation	-How would you describe your attitude towards innovation in information technology and experimenting with new technologies, and how open would you be to trying augmented and virtual reality technologies even if you currently do not use them? -How would you describe your inclination to experiment with new information technologies, including your motivation to try out new technologies like AR/VR applications, or others? -How would you describe your openness to new information technologies, particularly in the context of using AR/VR applications? Are you inclined towards exploring and experimenting with new technologies or do you prefer sticking to more familiar options?	-Agarawal & Prasad (1998)
Intention to use	-How would you describe your plans and intentions for future use of augmented and virtual reality technologies, despite not currently using them? -How would you describe your intention to use AR/VR technologies, including your willingness to use them regularly in the future, considering your experience and current benefits from them? -How would you describe your long-term intentions for using augmented and virtual reality technologies? Do you see AR/VR technologies as an integral part of your future everyday life or do you plan for their frequent use in the future?	-Yu et al. (2021) -Venkatesh et al. (2012)
Relationship between technology and marketing.	- How do you envision the role of augmented and virtual reality technologies and interaction with consumers? For instance, how would you like to see the implementation of AR/VR technologies in marketing campaigns and in what ways do you believe such innovations would enrich your consumer experience?	-Loureiro et al., (2019)

Source: Adapted by the authors

This framework enables a systematic and methodical approach to research, offering enhanced insight into participants' viewpoints, perceptions, and encounters concerning AR/VR technologies and their marketing dimensions.

Additionally, the study's limitations include a restricted research sample size, potentially limiting the generalizability of findings to the broader population. Moreover, the minimal implementation of marketing strategies utilizing AR/VR technologies in 2024 could affect the relevance and applicability of research findings. Addressing these limitations, future research efforts should aim to employ larger and more diverse samples, consider broader geographical contexts, and monitor the evolution of technology implementation over time to provide a more comprehensive understanding of the subject matter.

4. Findings and discussion

The investigation into individual's initial encounters with AR/VR technologies aims to deepen our understanding of their first exposures and experiences with these technologies. By fostering discussions about the various pathways and encounters that led to their familiarity with such technologies, the inquiry gathers relevant data to enrich the research. Among most respondents, AR/VR technologies were introduced through gaming and mobile phone usage. One response that stood out highlighted the significance of Pokémon Go in introducing users to AR: *"My first encounter with AR was through playing the game Pokémon Go on my phone. I remember playing it even at work."* This response not only confirms but also emphasizes the widespread popularity of Pokémon Go as one of the most prominent AR games to date (Landi, 2016). AR features have enhanced gaming experiences by introducing new levels of entertainment and interactivity, allowing users to engage with digital content in more immersive and dynamic ways. Additionally, by downloading mobile applications offering augmented reality features such as AR filters for photos and videos, users have been able to explore the practical applications of this technology in their daily lives. Through browsing online mobile app stores and digital game platforms, they have encountered various AR/VR contents and experimented with their functionalities, which has led to a deeper understanding of this technology before fully integrating it into their daily routines.

Questions were posed regarding the anticipated benefits, aiming to delve deeper into participants' perceptions of the potential advantages of AR/VR technologies, even if they are not currently using them. The insights obtained could provide guidance for further development and implementation of AR/VR technologies across various life domains.

Respondents in the focus groups showed a keen interest and identified tangible benefits in AR/VR applications, especially concerning the quicker completion of daily tasks and enhanced productivity. Their feedback indicates that these technologies offer innovative solutions to streamline various tasks, emphasizing practical uses like finding lost items or optimizing business task organization.

Participants underscored how utilizing AR/VR apps enables more effective time and resource management, leading to expedited processes and increased productivity. The statement *"I think AR could turn everyday tasks into something more enjoyable. For example, instead of boringly reading subjects on paper or a screen, imagine if each subject had its visual representation in augmented reality. That would definitely add an element of fun to the office, and maybe I would have more motivation to finish them more quickly." (M7)* is in accordance with the research by

Shiue et al. (2019), which further corroborates the findings of De Serio et al. (2013) demonstrating that enhanced learning outcomes are attainable through visualization in a multimedia learning environment.
In the discussion about usability and effort, participants expressed varying perceptions of the ease of use of AR/VR technologies. While some found the learning process relatively quick and intuitive, stating they easily adapted to new interfaces and features, others faced initial challenges. According to Venkatesh et al. (2003), the anticipated effort is crucial among the factors influencing the intention to use technology. Similar findings have been reported in other studies by Rahman et al. (2020) and L. Wang and Yi (2012).

However, most participants noted that they became more comfortable using these technologies over time, and perceived usability increased with experience. This diverse range of perceptions indicates a wide spectrum of experiences with AR/VR technologies, with individuals encountering the learning process and interacting with these technologies differently.

One participant responded: *"At first, the learning process was a bit challenging, but I adapted over time. I believe these technologies are an exceptional tool with tremendous potential, but their complexity requires time and practice to fully harness." (M10).*

These statements align with previous research studies (Ameri et al., 2020; Attuquayefio and Addo, 2014), indicating that the level of technical support expected by users from managers in work environments, technical service departments, and equipment suppliers significantly influences their intention to continue using immersive technologies like VR. Therefore, when introducing advanced IT equipment, it is crucial to prioritize training, enhance users' familiarity with the technology, and facilitate its convenient usage (Dalgarno et al., 2016; Myers et al., 2017).

This is consistent with the conclusions drawn by Chang et al. (2020) and Chien et al. (2020), suggesting the selection of VR devices with a simple interface and easy operation to facilitate a user-friendly experience. The research emphasizes the need for continuous education and support for users to facilitate their adoption of these technologies. By adapting user interfaces and providing clear usage guidelines, it is possible to enhance the user experience and encourage broader adoption of these technologies.

As part of the research, participants shared their perspectives on the social impact of augmented and virtual reality technologies. This segment of the discussion illuminated a wide range of views and perceptions on how these technologies shape society and interpersonal interactions. The questions posed provided deeper insights into how the opinions of participants' close acquaintances influenced their decisions regarding the use of these technologies.

Focus group participants emphasized the significant social influence on their decision to use AR/VR technologies: *"Well, you know, if my friends and close people expressed interest in or supported the use of these technologies, I would definitely be more inclined to use them too. Close people play an important role in decision-making for me, so if everyone sees the value in these technologies, I would probably be more open to them as well." (M4).* The opinions of their closest circles, such as family and friends, play a significant role in shaping attitudes towards these technologies.

Social influence plays a crucial role in the acceptance and integration of AR/VR technologies. The findings are consistent with Gharaibeh et al. (2021), suggesting that social influence plays

a role in the intention to use mobile AR in tourism in Jordan. This indicates that users are more interested in the recommendations and attitudes of their reference groups (such as friends, family members, co-workers, and colleagues) in shaping their intention to adopt mobile AR. Previous studies in the domain of social influence have emphasized the significance and positive impact of family members, co-workers, reference groups, friends, and elders on users' intention to adopt a technology (Antines & Amaro, 2016; Kraut et al., 1998).

In addition to providing support, the social environment can shape individuals' attitudes towards modern technologies. The opinions and experiences of close acquaintances can be instrumental in shaping an individual's stance on the use of AR/VR technologies. This aspect of the research highlights the complexity of the innovation adoption process, where social factors play a vital role alongside the technological characteristics of the products themselves. Furthermore, a sense of belonging and community support can have a positive impact on motivating individuals to explore and embrace new technological trends. Therefore, a thorough understanding and leveraging of social influences can be a significant factor in successfully integrating AR/VR technologies into everyday life.

In the study, participants were asked to consider factors that could affect their ability and willingness to use AR/VR technologies. The question aimed to identify factors such as the availability of necessary resources, such as appropriate hardware and software, and the compatibility of these technologies with their current devices. Additionally, participants were encouraged to consider whether they had access to assistance or support in case of difficulties in using these technologies.

Participants emphasized the importance of having the appropriate equipment, such as smart glasses or other specific devices, and wondered if their current devices supported such technologies. Most participants expressed a willingness to seek help from others to overcome any obstacles in using AR and VR technologies. This attitude of openness to seeking support underscores the importance of accessibility and assistance in the process of adopting and using these technologies.

One participant answered: *"Honestly, I have access to all the necessary resources for using augmented and virtual reality technologies. My smartphones and computer support these technologies. As for assistance, everything can be found on the internet or forums." (M7).* The responses were in line with the findings of Kocaleva et al. (2015), who surveyed 92 teachers to examine their attitudes toward e-learning. The study revealed that facilitating conditions had the most significant impact on their intention to use new technology. Among the seven UTAUT factors analyzed in the research, effort expectancy (86.4%) and facilitating conditions demonstrated the strongest effects (79.62%).

Responses highlight that support and resource availability are crucial for ensuring the successful introduction of new technologies, especially in the context of users with less experience in technology. Therefore, ensuring access to affordable educational materials and readily available support resources can significantly facilitate the adaptation process and enhance user experience with AR and VR technologies.

Hedonistic motivation, often associated with pleasure and enjoyment, plays a significant role in shaping attitudes and behaviors towards the adoption of technologies. This type of motivation stems from a desire for enjoyment and entertainment and can significantly influence how people perceive and use technologies.

In the study, participants were invited to share their opinions and experiences related to hedonistic motivation in the context of AR/VR technologies, providing insight into the factors contributing to their acceptance and usage. Responses from focus group participants clearly demonstrate the presence of hedonistic motivation in the use of AR/VR technologies. Some of the participants' responses were:

"I imagine I would feel like I've stepped into some futuristic world!" (M1).
"Oh, it's super fun. Virtual reality feels really, really amazing!" (W5).
"I have no words for virtual reality, it's a completely new dimension. Does it need more motivation?" (M11).
"AR is interesting, but virtual reality is something fantastic." (M9).

These responses are consistent with the study conducted by Faqih & Jaradat (2021), which indicates that hedonic motivation, focusing on the enjoyment and pleasure derived from using technology, positively influences the intention to adopt AR technology. This finding is in line with previous research results (Paulo et al., 2018; Kim & Hall, 2019; Salimon et al., 2017), suggesting that higher hedonic motivation correlates with a greater intention to adopt AR technology. This reinforces the significance of hedonic motivation in predicting a higher level of behavioral intention across various domains of information technology adoption.

Their statements highlight a desire to experience exciting and futuristic worlds, suggesting that these participants view such experiences as a source of entertainment and pleasure. Their enthusiasm indicates that using AR/VR technologies represents a positive emotional experience for them, encouraging them to further explore and use these technologies for entertainment and enjoyment.

The study further explores the role of hedonistic motivation in the context of using AR/VR technologies, emphasizing how this dimension of experience plays an important role in attracting users and maintaining their engagement. By creating rich and interactive content, it is possible to create experiences that are not only entertaining but also deeply satisfying for users, encouraging them to regularly return and explore new possibilities. This approach not only contributes to the widespread adoption of AR/VR technologies but also opens doors to innovative forms of entertainment and interaction in the digital world.
Questions about perceived value explore participants' subjective perception of the relationship between the price and quality of AR/VR technologies. The focus of these questions is on how participants perceive the adequacy of the price concerning the functionalities, performance, and other characteristics of these technologies. Additionally, it investigates their overall attitude towards investing in such technologies, in line with their perceptions of expected value and benefits.

While some participants emphasize awareness of the high costs of these technologies, considering them as barriers, others express a readiness to invest in technologies they see as useful and valuable. One of the participants' responses was: *"Basically, for me, it's important that the perceived value justifies the money spent in order for me to be motivated to continue using these technologies." (M12).*

This answer is in line with a study conducted by Gharabieh et al. (2021), where the significant relationship between price value and the intention to use mobile AR in tourism has been confirmed. Accordingly, respondents consider price value to be an important factor when deciding whether to accept or reject technology. Conversely, when the perceived benefits and

features of mobile AR in tourism increase in proportion to the financial cost required to use these systems, customers are more likely to be inclined to adopt mobile AR. This perspective aligns with the original UTAUT framework, which posited that users would consider adopting a technology if its benefits outweigh the costs (Venkatesh et al., 2012).

The influence of price value on customers' intention to use has been supported in numerous prior studies (Jung et al., 2016; Yuan et al., 2015; Tak & Panwar 2017). Therefore, it is important to emphasize that the perception of the value of AR/VR technologies often arises from users' expectations and the practical possibilities these technologies provide.

These responses underscore the significant role of perception and cost-effectiveness in making decisions about further use of these technologies. Their perception of the value of technologies can have a significant impact on their motivation for further exploration and use, so it is important to continuously work on improving the user experience and demonstrating the practical benefits that AR/VR technologies can bring.

The widespread adoption of technologies, including AR/VR, is evident in the increasing number of users worldwide incorporating these tools into their daily routines. Understanding the usage patterns and behaviors associated with these technologies is crucial to comprehending their impact, dependence, and role in users' lives.

Based on the responses gathered, it is evident that there is a diversity of perception and usage habits concerning AR/VR technologies among respondents. While some acknowledge the potential benefits and foresee future utilization in various aspects of life, such as entertainment, education, or professional development, others have already integrated these technologies into their daily routines and use them regularly. Although not experiencing a strong dependence, they recognize the utility of AR/VR as valuable tools in the digital age.

Conversely, some respondents currently do not perceive the need or habit for using these technologies but remain open to future adoption depending on evolving needs and technological advancements. One participant expressed: *"I use AR filters and similar features regularly. I wouldn't say I'm addicted, but I am accustomed to using them. I find them useful in today's digital age, especially AR." (M6).*

This response resonates with a study by Wen et al. (2023), which explored the use of AR/VR applications in heritage monuments. These diverse responses underline the importance of understanding user attitudes and needs to inform the development and adaptation of AR/VR technologies. This insight is vital for devising strategies that cater to various user requirements and preferences, ultimately fostering broader acceptance and usage of these technologies in the future.

In the contemporary digital landscape, interactivity stands as a pivotal element shaping user engagement with technologies. Augmented reality and virtual reality applications underscore the significance of interactivity, as they possess the ability to transform passive observation into dynamic engagement. One participant articulated this sentiment: *"I use AR/VR precisely because of their interactivity. The ability to communicate with objects around us in the virtual world is inherently fascinating. Of course, they make performing all tasks easier in this way." (M7).*

This observation resonates with existing research, indicating that interactivity with AR apps significantly influences consumer attitudes and behavioral intentions (McLean & Wilson, 2019; Park & Yoo, 2020). Through the responses garnered from focus group participants, it becomes evident that interactivity holds a crucial role in shaping the perception and experience of using AR and VR applications. Even participants who do not currently utilize these technologies acknowledge the importance of interactivity in enhancing user experience and facilitating task completion in an enjoyable manner.

Conversely, users already immersed in these technologies express satisfaction with their interactive features, emphasizing their role in streamlining daily tasks. These responses collectively highlight interactivity as a fundamental aspect in augmenting user experience and fostering continued engagement with AR and VR applications. Interactive functionalities not only empower users to actively participate but also stimulate their curiosity and eagerness to explore further. Therefore, it is imperative to develop applications that offer diverse interactive capabilities to cater to varying user preferences and needs. By doing so, widespread acceptance and sustained usage of AR and VR technologies can be achieved in the long term.

In today's digital era, embracing innovation in information technologies is pivotal for shaping both our personal lives and businesses. This openness extends beyond merely accepting new technologies; it involves a willingness to explore and experiment with them. Many individuals actively track emerging technological trends, eagerly embracing innovative applications, devices, or software as they emerge in the market. This proactive approach not only keeps users abreast of digital advancements but also fosters a culture of continuous learning and growth in the IT domain.

As a result, research on individuals' inclination towards IT innovations often centers on their readiness to explore new technologies, to be early adopters, and to experiment with them to enrich their digital experiences. The diverse attitudes observed among participants in focus groups regarding new information technologies underscore the breadth of perspectives in how people perceive and embrace innovations. While some exhibit enthusiasm and eagerness to explore novel technologies, others exercise caution and prefer sticking to familiar options.

Some of the responses were: *"I enjoy exploring and keeping up with trends. Technologies like AR/VR currently hold a lot of promise. Just the other day, I read that new, better VR glasses have been released. Pretty cool, right?" (M9*), and *"When it comes to new information technologies, I always maintain a certain level of caution and approach with moderate interest. I believe in the value of innovation, but at the same time, I appreciate playing it safe." (M14).*

This spectrum of attitudes underscores the importance of striking a balance between embracing new technological solutions and retaining the security provided by familiar tools. Moreover, it emphasizes the significance of acknowledging individual preferences and approaches towards technological changes, which are instrumental in successful technological adoption and integration into daily routines.

These findings resonate with a study by Agarawal & Prasad (1998), suggesting that personal innovativeness in IT could enhance comprehensive models of technology implementation, influencing decisions related to technology adoption. Given the diverse perspectives of users, it is imperative to offer flexible options and support mechanisms that cater to their individual needs and preferences. Additionally, continuous education and awareness initiatives about new

technologies play a pivotal role in fostering trust and promoting the widespread acceptance of innovations in broader societal contexts.

Augmented reality and virtual reality offer novel ways to engage with both the physical environment and the digital realm. As these technologies become more integrated into our daily activities, understanding users' intentions to use them becomes crucial. Analyzing the intention to use AR and VR provides valuable insights into how people perceive their utility and potential benefits across different aspects of life. Researching users' intentions regarding these technologies' sheds light on their readiness to adopt them in the future and their anticipated frequency of use in daily activities. The expressed intentions and attitudes of participants towards the future use of AR and VR technologies generally demonstrate optimism and openness. Even among those who currently do not use these technologies, there is a notable interest in their future utilization due to the recognized value and potential they offer. Some of the participants' responses were:

"While I'm not presently using AR and VR technologies, I'm intrigued by their potential future applications. I believe these technologies could greatly enhance experiences in various domains, including education, entertainment, and even the workplace." (W1).

"My intention to incorporate AR/VR technologies into my routine is aimed at regular use in the future. As I strive to stay updated on technological trends, I envision integrating these technologies into my daily life. I anticipate that further advancements will lead to more opportunities and enhanced applications, enriching my overall experience." (W5).

"I'm not currently utilizing these technologies, but I recognize their increasing relevance. I plan to explore them more openly in the future." (W2).

These responses are consistent with findings from studies on behavioral intention to use technology (Baabdullah et al., 2019; Badran, 2019; Macedo, 2017; Merhi et al., 2019). The attitudes of research participants clearly indicate a desire to integrate AR and VR technologies into various aspects of everyday life, such as education, entertainment, and professional development. Their expressed intention to regularly use these technologies in the future reflects a belief in their continued development and the anticipation of new possibilities they may bring. Ultimately, these responses suggest that AR and VR technologies will become pervasive, offering novel modes of interaction and enriching daily experiences. This widespread acceptance and utilization lay the foundation for further research and innovation in the field, unlocking diverse applications and opportunities across various spheres of human activity.

Technology and marketing have forged an inseparable alliance, fundamentally reshaping how companies interact with their target audience. The rapid pace of technological advancement continuously revolutionizes marketing strategies, introducing new tools and platforms for promoting products and services. Consequently, understanding the intricate relationship between technology and marketing becomes paramount for effectively positioning brands and attaining marketing objectives. Analyzing focus group participants' perceptions of this relationship provides valuable insights into their attitudes, perceptions, and expectations concerning the integration of technological innovations in the marketing domain.

From the analysis of participants' responses, it is evident that there exists a spectrum of views and perceptions regarding the role of technology in marketing. Some participants recognize the transformative potential of technological innovations in revolutionizing marketing strategies,

particularly through the adoption of virtual reality and interactive advertisements. For instance, one participant expressed, *"I think technology can make a real revolution in marketing. Imagine being able to try out a product before you buy it, all through virtual reality! That would be amazing, wouldn't it? And not only does it have, but also interactive ads that respond to your gestures or voice commanded. Technology has become part of marketing, as far as I can see." (M7).* This sentiment aligns with prior research, which has demonstrated that the virtual try-on experience with personalized virtual avatars can foster a positive attitude toward shopping technology and increase purchase intention (Chevalier & Lichtle, 2012; Keh et al., 2016; Plotkina & Saurel, 2019).

Conversely, others underscore the importance of consumers adapting to technological changes to remain abreast of the digital landscape's evolution. This underscores the dynamic nature of the relationship between technology and marketing, wherein innovations continually evolve to meet consumers' evolving needs. Ultimately, technology emerges as a pivotal tool in the marketer's arsenal, enabling brands to engage their target audience in novel and compelling ways. Through interactive experiences and personalized communication, technological innovations have the capacity to transform passive observers into actively engaged consumers. Moreover, as the technological landscape advances, consumers must embrace these changes to fully harness the benefits of the digital age. This entails embracing new technologies and acquiring the necessary skills to leverage them effectively, thereby enhancing their overall experience.

Ultimately, the successful integration of technology into marketing hinges on companies' ability to effectively leverage technological innovations to deliver relevant and valuable content to consumers, thereby creating positive experiences that consumers will appreciate and utilize. Given the ongoing evolution of technology and shifts in consumer preferences, companies must maintain agility and adaptability to remain competitive and relevant in the marketplace. This necessitates not only technical proficiency in implementing new technologies but also a profound understanding of consumer needs and preferences, along with the flexibility to adjust marketing strategies accordingly.

By continuously analyzing market trends and monitoring consumer reactions, companies can stay attuned to the dynamic environment, ensuring that their marketing endeavors align with the latest innovations and meet the expectations of their target audience. Furthermore, investing in education and empowering marketing teams to enhance their understanding and utilization of advanced technologies can be instrumental for long-term success in this domain. Through these concerted efforts, companies can effectively navigate the intersection of technology and marketing, driving innovation and delivering meaningful experiences that resonate with consumers.

5. Conclusion

This study highlights the transformative potential of AR/VR technologies across a range of societal domains. The findings indicate that AR/VR are not merely emergent tools of interaction but foundational components of future digital ecosystems. Their integration into fields such as education, marketing, and entertainment demonstrates the capacity of immersive technologies to reconfigure how individuals engage with content, services, and each other.

Key to the successful implementation of AR/VR technologies is ensuring broad accessibility and intuitive usability. Technological progress, in this context, must be inclusive, considering varying levels of digital literacy and access to infrastructure. Public education, user-centered design, and responsible deployment strategies are essential for mitigating exclusion and maximizing societal benefits.

Furthermore, the study emphasizes the necessity of building awareness around the social, emotional, and economic implications of immersive technologies. As AR/VR becomes increasingly embedded in everyday experiences, critical engagement with their long-term impact will become vital. Education systems, policy frameworks, and industry practices must co-evolve with these technologies to ensure they contribute to sustainable and equitable digital transformation.

6. Limitations and Future Work

The qualitative nature of this study provided valuable insights into user perceptions of AR/VR technologies. However, the limited sample size and context-specific focus constrain the generalizability of the findings. While the exploratory depth is a strength, broader quantitative analysis would be required to validate patterns and test hypotheses across larger populations.

Future research should consider adopting a mixed-methods approach, integrating qualitative richness with quantitative rigor. This would allow for a more holistic understanding of AR/VR adoption, including behavioral trends, user segmentation, and barriers to entry.

In addition, further inquiry into the cultural, economic, and infrastructural variables that influence AR/VR adoption in Bosnia and Herzegovina would be particularly valuable. Such insights would not only deepen theoretical contributions but also inform practical strategies for effective and inclusive implementation.

REFERENCES

Agarwal, R., Prasad, J. (1998): ***A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology.*** *Information Systems Research, 9*(2), pp. 204-224.

Ameri, A., Khajouei, R., Ameri, A., Jahani, Y. (2020): ***Acceptance of a mobile-based educational application (LabSafety) by pharmacy students: An application of the UTAUT2 model.*** *Education and Information Technologies, 25*(1), pp. 419–435.

Attuquayefio, S. N., & Addo, H. (2014): ***Using the UTAUT model to analyze students' ICT adoption.*** *International Journal of Education and Development Using Information and Communication Technology, 10*(3), pp. 75–86.

Azuma, R. T. (1997): ***A survey of augmented reality***. Presence, 6(4), pp. 355–385.

Azzahra, T. R., Kusumawati, N. (2023): ***The Impact of Mobile Service Quality, Perceived Value, Perceived Usefulness, Perceived Ease of Use, Customer Satisfaction Towards Continuance Intention to Use MyTelkomsel App.*** Journal of Consumer Studies and Applied Marketing, 1(1), pp. 46-60.

Baabdullah, A. M., Alalwan, A. A., Rana, N. P., Kizgin, H., & Patil, P. (2019): ***Consumer use of mobile banking (M-banking) in Saudi Arabia: Towards an integrated model.*** *International Journal of Information Management, 44*, pp. 38–52.

Badran, M. F. (2019): ***eHealth in Egypt: The demand-side perspective of implementing electronic health records.*** *Telecommunications Policy, 43*(6), pp. 576–594.

Baek, T. H., Yoo, C. Y., & Yoon, S. (2018): ***Augment yourself through virtual mirror: The impact of self-viewing and narcissism on consumer responses.*** International Journal of_Advertising, 37(3), pp. 421–439.

Batucan, G. B., Gonzales, G. G., Balbuena, M. G., Pasaol, K. R. B., Seno, D. N., Gonzales, R. R. (2022): ***An Extended UTAUT Model to Explain Factors Affecting Online Learning System Amidst COVID-19 Pandemic: The Case of a Developing Economy.*** Frontiers in Artificial Intelligence, Vol. 5, pp. 1-13.

Berg, L. P., & Vance, J. M. (2017): ***Industry use of virtual reality in product design and manufacturing: A survey.*** Virtual Reality, 21(1), pp. 1–17.

Berryman, D. R. (2012): ***Augmented reality: A review.*** Medical Reference Services Quarterly, 31(2), pp. 212–218.

Billinghurst, M., Clark, A., & Lee, G. (2015): ***A survey of augmented reality.*** Foundations and Trends in Human-Computer Interaction, 8(2–3), pp. 73–272.

Bonetti, F., Montecchi, M., Plangger, K., & Schau, H. J. (2022): ***Practice co-evolution: Collaboratively embedding artificial intelligence in retail practices.*** *Journal of the Academy of Marketing Science.* https://doi.org/10.1007/s11747-022-00896-1

Bown, J., White, E., & Boopalan, A. (2017): ***Looking for the ultimate display: A brief history of virtual reality.*** In J. Gackenbach, & J. Bown (Eds.), Boundaries of self and reality online: Implications of digitally constructed realities. London, United Kingdom: Elsevier. pp. 239-259.

Breidbach, C. F., & Maglio, P. P. (2016): ***Technology-enabled value co-creation: An empirical analysis of actors, resources, and practices.*** *Industrial Marketing Management, 56*(April), https://doi.org/10.1016/j.indmarman.2016.03.011. pp. 73 -85.

Chadha, R. (2019): ***Retailers and Shoppers Are on Totally Different Pages About Tech.*** *EMarketer*. pp. 1-7.

Chang, S. C., Hsu, T. C., Chen, Y. N., & Jong, M. S. Y. (2020): ***The effects of spherical video-based virtual reality implementation on students' natural science learning effectiveness.*** *Interactive Learning Environments, 28*(7), pp. 915–929.

Chevalier, C., & Lichtlé, M. C. (2012): ***The Influence of the Perceived Age of the Model Shown in an Ad on the Effectiveness of Advertising.*** *Rech. Appl. Mark. Engl. Ed., 27*, pp. 3–19.

Chien, S. Y., Hwang, G. J., & Jong, M. S. Y. (2020): ***Effects of peer assessment within the context of spherical video-based virtual reality on EFL students' English-Speaking performance and learning perceptions.*** *Computers & Education, 146*(3), 103751.

Christensen, M. C. (1997): ***The Innovator's Dilemma When New Technologies Cause Great Firms to Fail.*** *Harvard Business School Press*

Dalgarno, B., Gregory, S., Knox, V., & Reiners, T. (2016): ***Practising teaching using virtual Classroom role plays.*** *Australian Journal of Teacher Education, 41*(1), pp. 126–154.

De Serio, A., Ibanez, M. B., & Kloos, C. D. (2013): ***Impact of an augmented reality for the classroom.*** *Computers and Education, 68*, pp. 557-568.

Dellaert, B. G. C. (2019): ***The consumer production journey: marketing to consumers as co-producers in the sharing economy.*** *Journal of the Academy of Marketing Science, 47*(2). https://doi.org/10.1007/s11747-018-0607-4. pp. 238-254.

Fan, X., Chai, Z., Deng, N., & Dong, X. (2020): ***Adoption of augmented reality in online retailing and consumers' product attitude: A cognitive perspective.*** Journal of Retailing and Consumer Services, 53, 101986. https://doi.org/10.1016/j.jretconser.2019.101986

Faqih, K. M., & Jaradat, M. I. R. M. (2021): ***Integrating TTF and UTAUT2 theories to investigate the adoption of augmented reality technology in education: Perspective from a developing country.*** *Technology in Society, 67*, 101787.

Feiner, S., MacIntyre, B., Haupt, M., & Solomon, E. (1993): ***Windows on the world: 2D windows for 3D augmented reality.*** In Proceedings of the 6th annual ACM symposium on User interface software and technology, pp. 145–155.

Fertleman, C., Aubugeau-Williams, P., Sher, C., Lim, A. N., Lumley, S., Delacroix, S., & Pan, X. (2018): ***A discussion of virtual reality as a new tool for training healthcare professionals.*** Frontiers in Public Health, 6(44), pp. 1–5.

Georgiadis, C. (2022): ***How technology will revolutionize marketing in 2022 And Beyond***, *Forbes, February 4*.

Gharaibeh, M. Khlaif, Gharaibeh, N. Khlaif M., Ayoub Khan, W. Abdel Karim Abu-ain & M. Kasim Alqudah (2021): ***Intention to use mobile augmented reality in the tourism sector.*** Computer Systems Science and Engineering, 37(2), pp.187–202.

Grewal, D., Hulland, J., Kopalle, P. K., & Karahanna, E. (2019): ***The future of technology and marketing: a multidisciplinary perspective.*** *Journal of the Academy Marketing Science*. pp. 1-8.

Hamilton, R. (2016): ***Consumer-based strategy: Using multiple methods to generate consumer insights that inform strategy.*** Journal of the Academy of Marketing Science, 44(3). https://doi.org/10.1007/s11747-016-0476-7. pp. 281-285.

Heller, J., Chylinski, M., de Ruyter, K., Keeling, D. I., Hilken, T., & Mahr, D. (2021): ***Tangible service automation: Decomposing the technology-enabled engagement process (TEEP) for augmented reality.*** Journal of Service Research, 24(1), pp. 84–103.

Hildebrand, C., & Schlager, T. (2019): ***Focusing on others before you shop: exposure to Facebook promotes conventional product configurations.*** Journal of the Academy of Marketing Science, 47(2). https://doi.org/10.1007/s11747-018-0599-0. pp. 291-307.

Hoffman, D. L., Moreau, C. P., Stremersch, S., & Wedel, M. (2022): ***The rise of new technologies in marketing: A framework and outlook.*** Journal of Marketing, 86(1), pp. 1–6.

Jeon, C. (2015): ***The virtual flier: The link trainer, flight simulation, and pilot identity.*** Technology and Culture, 56(1), pp. 28–53.

Jung, T., Dieck, M. C. T., Lee, H., & Chung, N. (2016): ***Effects of virtual reality and augmented reality on visitor experiences in museum.*** In Information and Communication Technologies in Tourism, pp. 621–635.

Keh, H. T., Park, I. H., Kelly, S., & Du, X. (2016): ***The effects of model size and race on Chinese consumers' reactions: A social comparison perspective.*** Psychological Marketing, 33, pp. 177–194.

Kim, J. H., Kim, M., Park, M., & Yoo, J. (2023): ***Immersive interactive technologies and virtual shopping experiences: Differences in consumer perceptions between augmented reality (AR) and virtual reality (VR).*** Telematics and Informatics, 77, 101936.

Kim, M.J., Hall, C. M., (2019): ***A hedonic motivation model in virtual reality tourism: comparing visitors and non-visitors.*** International Journal of Information Management, 46, pp. 236–249.

Kim. S. S., Malhorta, N. K., Narasimhan, S. (2005): ***Two Competing Perspectives on Automatic Use: A Theoretical and Empirical Comparison.*** Information System Research, 16(4), pp. 418-432.

Klico, A. (2022): ***How using virtual reality can improve B2B marketing.*** BH Ekonomski forum, 17(2). pp. 27-40

Klie, L. (2012): ***Gen X: Stuck in the middle.*** Customer Relationship Management, pp.24-29.

Kocaleva, Mirjana & Stojanovic, Igor & Zdravev, Zoran. (2015): ***Model of e-Learning Acceptance and Use for Teaching Staff in Higher Education Institutions.*** International Journal of Modern Education and Computer Science (IJMECS). 7. pp. 23-31.

Krasonikolakis, I., Vrechopoulos, A., Pouloudi, A., & Dimitriadis, S. (2018): ***Store layout effects on consumer behavior in 3D online stores.*** European Journal of Marketing, 52 (5/6), pp.1223–1256.

Kraut, R. E., Rice, R. E., Cool, C., & Fish, R. S. (1998): ***Varieties of social influence: The role of utility and norms in the success of a new communication medium.*** Organization Science, 9(4), pp.437–453.

Landi, M. (2016): ***Pokemon Go app named as the most popular game of 2016 on Google Play. Mirror.*** Retrieved from http://www.mirror.co.uk/tech

Lee, H., Jung, T. H., Tom Dieck, M. C., & Chung, N. (2020): ***Experiencing immersive virtual reality in museums.*** Information & Management, 57(5), 103229.

Limayem, M., Hirt, S. G. (2003): ***Force of Habit and Information Systems Usage: Theory and Initial Validation.*** Journal of the Association for Information Systems, Vol. 4, pp. 65-97.

Loureiro, S. M. C., Guerreiro, J., Eloy, S., & Langaro, D. (2019): **Understanding the use of virtual reality in marketing: A text mining-based review.** Journal of Business Research, 100. https://doi.org/10.1016/j.jbusres.2018.10.055. pp. 514-530

Macedo, I. M. (2017): ***Predicting the acceptance and use of information and communication technology by older adults: An empirical examination of the revised UTAUT2.*** Computers in Human Behavior, 75, pp.935–948.

McLean, G., & Wilson, A. (2019): ***Shopping in the digital world: examining customer engagement through augmented reality mobile applications.*** Computers in Human Behavior, 101, pp.210–224.

Merhi, M., Hone, K., & Tarhini, A. (2019): ***A cross-cultural study of the intention to use mobile banking between Lebanese and British consumers: Extending UTAUT2 with security, privacy and trust.*** Technology and Society, 59, 101151.

Milgram, P., Takemura, H., Utsumi, A., & Kishino, F. (1995): ***Augmented reality: A class of displays on the reality-virtuality continuum.*** In Telemanipulator and telepresence technologies, International Society for Optics and Photonics. Vol. 2351, pp.282–292.

Miller, M. R., Jun, H., Herrera, F., Yu Villa, J., Welch, G., & Bailenson, J. N. (2019): ***Social interaction in augmented reality.*** PLoS One, 14(5).

Myers, D., Sugai, G., Simonsen, B., & Freeman, J. (2017): ***Assessing teachers' behavior support skills.*** Teacher Education and Special Education, 40(2), pp.128–139.

Novak, T., & Hoffman, D. L. (2019): ***Relationship journeys in the Internet of Things: A new framework for understanding interactions between consumers and smart objects.*** Journal of the Academy of Marketing Science, 47(2), pp.216–237.

Pagani, M., & Pardo, C. (2017): ***The impact of digital technology on relationships in a business network.*** *Industrial Marketing Management, 67*(September 2016), 185–192. https://doi.org/10.1016/j.indmarman.2017.08.009. pp. 185-192.

Park, M., & Yoo, J. (2020): ***Effects of perceived interactivity of augmented reality on consumer responses: a mental imagery perspective.*** *Journal of Retailing and Consumer Services, 52*, 101912.

Paulo, M.M., Rita, P., Oliveira, T., Moro, S., (2018): ***Understanding mobile augmented reality adoption in a consumer context.*** Journal of Hospitality and Tourism Technology, 9(2), pp.142–157.

Peštek, A., & Čičić, M. (2010): ***Application of E-marketing Strategies in Tourism Sector in Bosnia and Herzegovina.*** In 5th International Conference "An Enterprise Odyssey: From Crisis to Prosperity – Challenges for Government and Business". Opatija: Faculty of Economics and Business in Zagreb, Croatia, May 2010, Proceedings. pp. 1683-1697.

Piancatelli, C., Massi, M., & Vocino, A. (2021): ***The role of atmosphere in Italian museums: Effects on brand perceptions and visitor behavioral intentions.*** Journal of Strategic Marketing, 29(6). https://doi.org/10.1080/0965254X.2020.1786846. pp. 546-566

Plotkina, D., & Saurel, H. (2019): ***Me or just like me? The role of virtual try-on and physical appearance in apparel M-retailing.*** *Journal of Retailing and Consumer Services, 51*, pp. 362–377.

Prensky, M. (2001): ***Digital Natives, Digital Immigrants Part 1***. On the Horizon, Vol. 9 No. 5, https://doi.org/10.1108/10748120110424816. pp 1-6.

Rahman, S. A., Didarul Alam, M. M., & Taghizadeh, S. K. (2020): ***Do mobile financial services ensure the subjective well-being of micro-entrepreneurs? An investigation applying UTAUT2 model.***

Rauschnabel, P. A., Felix, R., & Hinsch, C. (2019): ***Augmented reality marketing: How mobile AR-apps can improve brands through inspiration.*** Journal of Retailing and Consumer Services, 49, pp. 43–53.

Rolph, D. (2016): ***Is Virtual Reality A Viable Investment?*** *Forbes.* Retrieved from https://www.forbes.com/sites/duncanrolph/2016/03/28/is-virtual-reality-a-viableinvestment/#5ffc55042cbe. pp. 2-7.

Salimon, M.G., Yusoff, R.Z.B., Mokhtar, S.S.M., (2017): ***The mediating role of hedonic motivation on the relationship between adoption of e-banking and its determinants.*** International Journal of Bank Marketing, 35(4), pp. 558–582.

Shahab, M. H., Ghazali, E., & Mohtar, M. (2021): ***The role of elaboration likelihood model in consumer behavior research and its extension to new technologies: A review and future research agenda.*** International Journal of Consumer Studies, 45(4), pp. 664–689.

Shiue, Y. M., Hsu, Y. C., Sheng, M. H., & Lan, C. H. (2019): ***Impact of an augmented reality system on students' learning performance for a health education course.*** International Journal of Management, Economics and Social Sciences (IJMESS), 8(3), pp. 195-204.

Sotiriadis M., & Shen S. (2023): ***Determining the Key Drivers for the Acceptance and Usage of AR and VR in Cultural Heritage Monuments.*** Sustainability, 15(5), 4146. DOI: 10.3390/su15054146.

Stadler, S., Cornet, H., Theoto, T. N., & Frenkler, F. (2019): ***A tool, not a toy: Using virtual reality to evaluate the communication between autonomous vehicles and pedestrians.*** In Augmented reality and virtual reality. Cham, Switzerland: Springer. pp. 203-216

Syed, T. A., Siddiqui, M. S., Abdullah, H. B., Jan, S., Namoun, A., Alzahrani, A., ... & Alkhodre, A. B. (2022): ***In-depth review of augmented reality: Tracking technologies, development tools, AR displays, collaborative AR, and security concerns.*** Sensors, 23(1), pp.146.

Swaminathan, V., Sorescu, A., Steenkamp, J. B. E. M., O'Guinn, T. C. G., & Schmitt, B. (2020): ***Branding in a Hyperconnected World: Refocusing Theories and Rethinking Boundaries.*** Journal of Marketing, 84(2), pp. 24–46.

Tak, P., & Panwar, S., (2017): ***Using UTAUT2 model to predict mobile app based shopping: Evidences from India.*** *Journal of Indian Business Research, 9*(3), pp. 248–264.

Tan, Y. C., Chandukala, S. R., & Reddy, S. K. (2021): ***Augmented reality in retail and its impact on sales.*** Journal of Marketing, Article 0022242921995449.

van Esch, P., Arli, D., Gheshlaghi, M. H., Andonopoulos, V., von der Heidt, T., & Northey, G. (2019): ***Anthropomorphism and augmented reality in the retail environment.*** Journal of Retailing and Consumer_Services, 49, Scopus. https://doi.org/10.1016/j.jretconser.2019.03.002. pp. 35-42

Venkatesh, V., Davis, G., Morris, M. G., & Davis, F. D. (2003): ***User acceptance of information technology: Toward a unified view.*** MIS Quarterly, 27(3), pp. 425.

Venkatesh, V., Thong, L. J., & Xu, X. (2012): ***Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology.*** MIS Quarterly, 36(1), pp. 157–178.

Verhoef, P. C. (2021): ***Omni-channel retailing: Some reflections. Journal of Strategic Marketing***, 29(7). https://doi.org/10.1080/0965254X.2021.1892163. pp. 608–616

Volti, R. (2014): ***Society and Technological Change*** (7th Ed.). New York, NY: Worth Publishers.

Wang, L., & Yi, Y. (2012): ***The impact of use context on mobile payment acceptance: An empirical study in China.*** In A. Xie & X. Huang (Eds.), Advances in computer science and education. Springer. DOI: 10.1007/978-3- 642-27945-4_47. pp. 239-299.

Wei, W., Qi, R., & Zhang, L. (2019): ***Effects of virtual reality on theme park visitors' experience and behaviors: A presence perspective.*** Tourism Management, 71, pp. 282–293.

Weiss, R. (2014): ***Learning from Strangers.*** New York: The Free Press.

Wen, X., Sotiriadis, M., & Shen, S. (2023): ***Determining the key drivers for the acceptance and usage of AR and VR in cultural heritage monuments.*** *Sustainability*, *15*(5), 4146.

Yaoyuneyong, G. S., Pollitte, W. A., Foster, J. K., & Flynn, L. R. (2018): ***Virtual dressing room media, buying intention and mediation.*** The Journal of Research in Indian Medicine, 12(1), pp.125–144.

Yin, C. Z. Y., Jung, T., Tom Dieck, M. C., & Lee, M. Y. (2021): ***Mobile augmented reality heritage applications: Meeting the needs of heritage tourists.*** Sustainability, 13(5), pp. 2523.

Yu, C. W., Chao, C. M., Chang, C. F., Chen, R. J., Chen, P. C., Liu, Y. X. (2021): ***Exploring Behavioral Intention to Use a Mobile Health Education Website: An Extension of the UTAUT 2 Model.*** SAGE Open, pp. 1-12.

Yuan, S., Ma, W., Kanthawala, S., & Peng, W. (2015): ***Keep using my health apps: Discover users' perception of health and fitness apps with the UTAUT2 model.*** Telemedicine and e-Health, 21(9), pp. 735–741.

Zhou, F., Duh, H. B. L., & Billinghurst, M. (2008): ***Trends in augmented reality tracking, interaction and display: A review of ten years of ISMAR.*** In 2008 7th IEEE/ACM International symposium on mixed and augmented reality, pp. 193–202.

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BEST PRACTICES AND GOOD NEIGHBOURS: HOW INSTITUTIONAL ISOMORPHISM INFLUENCES CIRCULAR ECONOMY PRACTICES THROUGH PERCEIVED CORPORATE SOCIAL RESPONSIBILITY

ABSTRACT

Despite the importance of CSR and CE in fostering socially responsible and sustainable business practices, the literature has overlooked the role of perceived CSR (PCSR) as an antecedent of the firms' orientation toward the circular economy (OCE). This study addresses this gap by examining the relationship between PCSR and OEC through the lens of institutional theory, which identifies three isomorphic forces that shape organisational behaviour: (1) coercive pressures from resource-controlling institutions capable of imposing sanctions for non-compliance; (2) normative pressures derived from socio-cultural expectations to adhere industry norms and values; and (3) mimetic pressures reflecting the voluntary imitation of successful industry peers. Using a sample of 74 Portuguese firms, this research applies partial least squares structural equation modelling (PLS-SEM) to analyse how these institutional forces moderate the relationship between PCSR and OCE. The findings indicate that PCSR drives firms toward CE adoption, with coercive isomorphism enhancing the strategic value of this relationship. Contrary to initial expectations, neither normative nor mimetic isomorphism demonstrated a significant moderating effect on the PCSR-CE relationship. We provide theoretical arguments to elucidate this counterintuitive finding, thereby revitalising the discussion about the complex interplay between PCSR, institutional isomorphism, and OEC.

Key words: *corporate social responsibility, isomorphic forces, circular economy, institutional theory.*

1. Introduction

As social expectations for corporate environmental and social responsibility continue to rise, organisations and their supply chains are under increasing pressure to adopt more sustainable operational practices (Santiago *et al*., 2025). Corporate social responsibility (CSR) represents a strategic approach through which firms voluntarily integrate economic, social, and

environmental considerations into their business models (Gallardo-Vázquez *et al.*, 2024). By fostering the authenticity of socially responsible initiatives, CSR supports the development of corporate governance frameworks that balance short- and long-term sustainability objectives (Santiago *et al.*, 2025).

Within this domain, the circular economy (CE) emerges as a crucial component of sustainable business strategies, aligning with the United Nations' (UN) goal of promoting responsible consumption and production (Santiago *et al.*, 2025). The CE model prioritises resource efficiency through reuse, repurposing, and recycling, reducing environmental impact and waste generation (Fontoura *et al*., 2023). It also encourages organisations to design products, manufacturing processes, and supply chain systems that facilitate continuous resource flow within a closed-loop framework (Jawahir and and Bradley, 2016).

Despite the conceptual proximity between CSR and CE, limited scholarly attention has been given to how firms' engagement in CE practices is shaped by their perceived commitment to social responsibility (Gallardo-Vázquez et al., 2024; Nsiah-Sarfo *et al*., 2023; Santiago *et al.*, 2025). Specifically, the literature has largely overlooked the role of perceived corporate social responsibility (PCSR) – stakeholders' perceptions of a firm's social and environmental commitments – as a strategic antecedent of a firm's orientation toward circular economy (OCE). This is especially relevant in the context of small and medium-sized enterprises (SMEs) operating in open, export-driven economies, where firms face institutional pressures from domestic and international stakeholders.

To address this gap, we draw on institutional theory (DiMaggio and Powell, 1983), which offers a robust lens for understanding how firms respond to external pressures in socially legitimised ways. The theory identifies three isomorphic forces that shape organisational behaviour: coercive pressures (e.g., regulatory requirements, stakeholder expectations), normative pressures (e.g., industry values, professional standards), and mimetic pressures (e.g., imitation of successful peers) (Nsiah-Sarfo *et al*., 2023). These forces are expected to moderate the relationship between PCSR and OCE by either reinforcing or constraining a firm's strategic alignment with circular economy practices

Building on this foundation, this study addresses two research questions: *To what extent does PCSR influence firms' OEC? What role do institutional pressures play in this process?* We employ partial least squares structural equation modelling (PLS-SEM) based on data collected from 74 manufacturing-exporting Portuguese SMEs to answer these questions. PLS-SEM is well suited for our model, given its predictive orientation, ability to handle complex relationships with smaller sample sizes, and accommodation of latent variables (Hair *et al.*, 2019). The Portuguese context offers a compelling case for examining institutional pressures, as firms need to address both EU-level sustainability requirements and domestic socio-economic constraints.

The empirical findings indicate that PCSR positively influences firms' orientation toward CE, suggesting that perceptions of responsibility can motivate operational shifts toward circularity. Interestingly, while coercive isomorphic pressures significantly strengthen this relationship, neither normative nor mimetic pressures showed significant moderating effects. These results highlight the asymmetric influence of institutional forces in sustainability transitions and suggest that regulatory compliance and stakeholder influence can play a more pivotal role than peer benchmarking or normative conformity.

From a theoretical point of view, this study contributes to integrating institutional theory within CSR and CE literature, advancing our understanding of how perceived legitimacy affects sustainability adoption. From a managerial perspective, the findings offer actionable strategies: firms aiming to advance CE practices should build genuine CSR strategies and communicate them effectively to stakeholders to enhance perceived legitimacy, especially in environments subject to regulatory scrutiny or market-based resource dependencies.

2. Theoretical background

2.1. Corporate social responsibility and circular economy orientation

The Green Book defines corporate social responsibility (CSR) as "*the voluntary integration, by companies, of social concerns and emerging in their commercial operations and their relations with their interlocutors*" (Commission of European Communities, 2001, p. 7). This definition underlines CSR as a strategic approach that aligns with firms' core objectives and competencies, fostering commercial value creation and positive social changes (Gallardo-Vázquez *et al*., 2024). By incorporating business practices that generate economic, social, and environmental impacts, CSR plays a crucial role in shaping a firm's long-term sustainability and ethical engagement (De Zoysa and Takaoka, 2019).

Extensive research has established a strong link between the voluntary adoption of CSR initiatives and improved performance (Camilleri, 2022), particularly within traditional linear business models. Several scholars suggest that firms engaging in CSR practices tend to achieve greater competitiveness (Yu *et al.*, 2017), enhanced financial performance (Siueia *et al*., 2019), and a stronger corporate reputation (Nardella *et al*., 2023). These findings collectively indicate that CSR serves as a key driver of business growth and innovation while simultaneously addressing the interests of multiple stakeholders (Eid and Loon, 2023). However, as the European Commission (2014) highlights, the traditional linear economic model – built on assumptions of resource abundance, accessibility, and low-cost disposal – is no longer viable. This shift poses a significant challenge to global competitiveness, imposing the transition toward a more sustainable, circular economy framework (Gallardo-Vázquez *et al.*, 2024).

The circular economy (CE) represents an alternative approach that emphasises resource efficiency, waste reduction, and sustainable production. It incorporates strategies such as the reuse of by-products, the shared infrastructure application, and standard service integration (Lozano and Lozano, 2024), facilitating a more effective and responsible use of natural resources. CE provides a foundation for developing production systems that minimise health-related risks and aligns with the environmental pillar of the triple bottom line (TBL) framework (Jeurissen, 2000). Empirical evidence supports that adopting a TBL approach contributes to environmental protection (Wiebe *et al*., 2023) and promotes conscious, sustainable consumption behaviours. From an environmental perspective, CE can take multiple strategic directions, including (a) reducing material and energy consumption, (b) promoting cleaner production methods, (c) optimising resource use, (d) minimising pollution, and (e) increasing overall operational efficiency (Jun and Xiang, 2011).

While existing research has explored several dimensions of CSR and CE, the predominant focus has been on value creation through CSR initiatives and sustainable development (Gallardo-Vázquez *et al.*, 2024), the relationship between CSR and corporate reputation

(Nardella *et al*., 2023), and the financial advantages of CE implementation (Kumar & Dua, 2022). However, it is essential to recognise that managers' perceptions of CSR are inherently subjective, influenced by their interpretations of their organisation's CSR commitments, which may not always align with the initiatives undertaken (Azim, 2016). Based on this assumption, the present research assumes that managers demonstrating heightened environmental awareness are more likely to embrace circular production models (Gallardo-Vázquez *et al.*, 2024; Khan *et al.*, 2020). The current study thus includes the following hypothesis:

Hypothesis 1. *Perceived CSR positively influences a firm's orientation toward the circular economy.*

2.2. The moderating role of isomorphic forces

The institutional theory posits that organisations gradually become more isomorphic as they integrate established institutional norms and structures to achieve legitimacy (Colwell and Joshi, 2013). This theory identifies three distinct mechanisms – coercive, mimetic, and normative isomorphism – through which organisations align with their institutional environments (DiMaggio and Powell, 1983). Isomorphism is, therefore, conceptualised as a constraining process that compels organisations within a given field to adopt similar structures and practices in response to shared environmental conditions (DiMaggio and Powell, 1983).

Coercive isomorphism arises from formal and informal pressures exerted by regulatory bodies and other influential stakeholders that constrain an organisation's strategic choices, compelling compliance with institutional expectations. In the environmental context, coercive forces manifest through government-imposed pollution control targets, regulatory compliance monitoring, and financial incentives or penalties designed to promote sustainable business practices (Colwell and Joshi, 2013).

Mimetic isomorphism occurs when organisations voluntarily imitate the strategies and structures of successful industry peers, particularly in uncertain environments where the best course of action is unclear. Organisations assume that adopting practices from more established firms may enhance their competitiveness or mitigate risks of strategic misalignment (DiMaggio and Powell, 1983). This imitation is based on the belief that successful firms possess superior knowledge or that aligning with their practices will prevent long-term competitive disadvantages (Colwell and Joshi, 2013).

Normative isomorphism, by contrast, stems from the professionalisation of industries and the diffusion of best practices through education, industry associations, and professional networks. Organisations become socialised within their institutional contexts, gradually internalising shared norms and values that shape strategic decision-making (Di Maggio and Powell, 1983). Unlike coercive isomorphism, which enforces conformity through external pressures, normative isomorphism fosters alignment by embedding institutionally preferred approaches within organisational culture and decision-making processes (Colwell and Joshi, 2013).

Previous studies highlight the influence of institutional pressures on organisations' sustainability efforts, demonstrating that external environmental forces often drive firms toward adopting responsible business practices (Dubey *et al.*, 2019a). Normative, coercive,

and mimetic isomorphism have been identified as significant antecedents of environmental strategies (Nsiah-Sarfo *et al*., 2023), contributing to financial performance and corporate market value (Kumar and Dua, 2022). In this context, institutional theory offers valuable inputs into the transition from a linear to a circular economic model (Gallardo-Vázquez *et al.*, 2024). For instance, Gemechu *et al.* (2014) found that environmental economic policies, such as carbon taxes, can influence firm behaviour by increasing costs. Tax incentives may serve as catalysts for sustainable practices. Similarly, Larrán *et al.* (2016) concluded that coercive and mimetic isomorphism are key in driving sustainability, particularly when regulatory frameworks align with corporate environmental policies.

From the neo-institutional perspective, suppliers exert significant pressure on firms to integrate eco-friendly CSR practices, thereby displaying a relevant effect on the firms' orientation toward the circular economy (OEC) (Dubey *et al.,* 2019b). Furthermore, increasing regulatory and market pressures to adopt recycling and waste reduction strategies further encourage CE adoption (Gallardo-Vázquez *et al.*, 2024; Khan *et al*., 2020). Empirical evidence suggests that all three forms of institutional isomorphism are key determinants of environmentally responsible business practices (Daddi *et al.*, 2021; Qi *et al.*, 2022). Building on this framework, coercive, normative, and mimetic isomorphisms are expected to reinforce firms' commitment to circular production from a CSR perspective (Gallardo-Vázquez *et al.*, 2024). Accordingly, the following additional hypotheses are proposed:

Hypothesis 2. *Coercive isomorphism positively moderates the relationship between perceived CSR and firms' orientation towards the circular economy (OEC), such that the OEC will be stronger as coercive isomorphism increases.*

Hypothesis 3. *Normative isomorphism positively moderates the relationship between perceived CSR and firms' orientation towards the circular economy (OEC), such that the OEC will be stronger as normative isomorphism increases.*

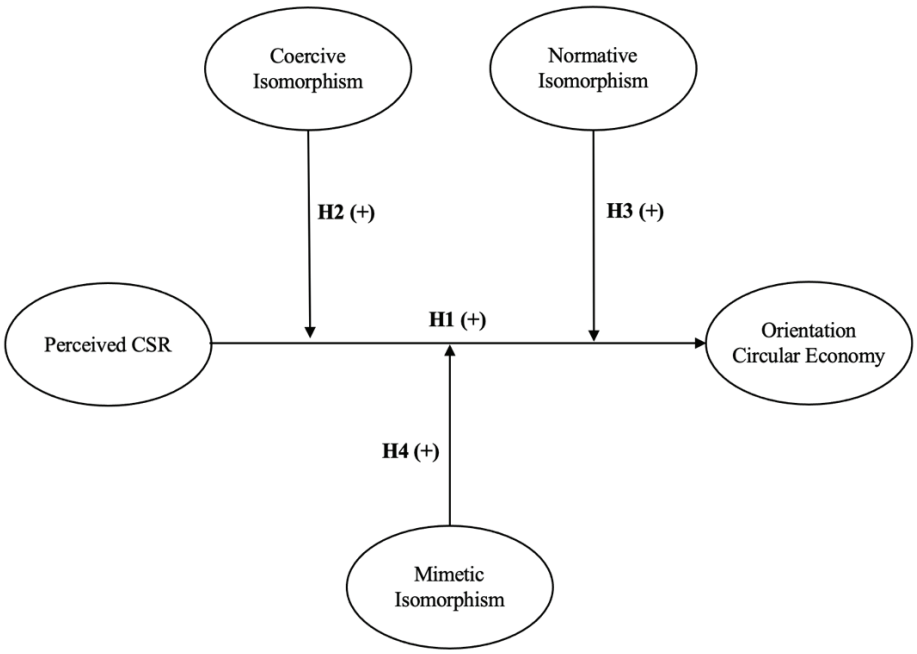
Hypothesis 4. *Mimetic isomorphism positively moderates the relationship between perceived CSR and firms' orientation towards the circular economy (OEC), such that the OEC will be stronger as mimetic isomorphism increases.*

2.3. Circular economy and international small and medium-sized enterprises

To analyse our research model (Figure 1) and the proposed relationships, we focus on small and medium-sized enterprises (SMEs). Scholars have suggested that adopting environmentally oriented strategies can be particularly challenging for SMEs due to resource constraints (Courrent *et al.*, 2018). However, SMEs also possess unique characteristics that enable a more nuanced analysis of these challenges and opportunities (Schmidt *et al.*, 2021). According to Courrent *et al.* (2018), SMEs exhibit several features that might facilitate the integration of CE practices. First, their relatively simple capital structures can enable managers to make environmentally oriented investments with minimal bureaucratic justification. Second, SMEs often demonstrate high flexibility in responding to evolving stakeholder expectations. Third, their less hierarchical and structurally complex nature can lower coordination costs (Courrent *et al.*, 2018), enhancing internal collaboration in implementing sustainability initiatives. Additionally, given their resource limitations, SMEs may display a greater tendency to engage in external partnerships (Courrent *et al.*, 2018), a crucial factor in successfully adopting CE practices (Schmidt *et al.*, 2021).

Moreover, as SMEs become increasingly embedded within global supply chains, their potential contribution to sustainable development grows. Consequently, sustainability has emerged as a critical concern in international business research (Gonçalves *et al.*, 2024). This body of literature highlights the importance of firms' resources and networks in adopting environmental practices to comply with regulations and overcome green trade barriers that may restrict product exports. Given that research on strategic orientations and CE implementation in SMEs remains in its early stages (Courrent *et al.*, 2018; Schmidt *et al.*, 2021) and considering that participation in international networks and cross-border collaborations fosters the development of eco-friendly offerings while facilitating compliance with environmental regulations (Gonçalves *et al.*, 2024), we position international SMEs as a relevant empirical context for advancing this emerging research stream.

Figure 1: Research model



Source: Authors

3. Methodology

3.1. Data collection and sample

The data were gathered through an online structured questionnaire, employing the key informant technique. The sampling frame consisted of Portuguese international SMEs operating in the manufacturing sector (NACE codes 10 to 32), established between 2005 and 2010, with at least one year of international activity between 2005 and 2015. The decision to include firms within this 10-year timeframe was intended to capture SMEs at different stages of their internationalisation strategy. The list of potential respondents was obtained from the Iberian Balance Analysis System (SABI database), comprising 771 firms with available contact information.

An email containing a link to the survey was sent to all identified firms to facilitate participation. The target informants were senior executives or export managers, as they were expected to possess the most comprehensive knowledge of their firm's exporting activities. The data collection process took place between January and March 2025. Of the 771 firms initially contacted, 36 could not be reached due to invalid email addresses, leaving 735 firms that successfully received the survey. By the end of the data collection period, 74 fully completed questionnaires were obtained from firms with less than 250 employees, aligning with the European Union's SME classification (European Commission, 2015), resulting in a response rate of 10.1%. Table 1 presents the main characteristics of the respondent firms.

Table 1: Sample characteristics

Characteristics	Responses	Frequency	Percentage (%)
Gender	Female	22	29.7
	Male	52	70.3
Age	20-30 years	4	5.4
	31-40 years	9	12.2
	41-50 years	22	29.7
	More than 50 years	39	52.7
Managerial responsibilities	Administrative position	39	52.7
	Middle management	9	12.2
	Other position (e.g., executive position)	26	35.1
Organisation dimension	1-9 employees	35	47.3
	10-49 employees	26	35.1
	50-250 employees	13	17.6

Source: Authors

The study employed partial least squares structural equation modelling (PLS-SEM) to analyse the research model. PLS-SEM is a composite-based method that is particularly well suited for theory testing with a predictive approach (Hair *et al.,* 2019). This method is advantageous for estimating and evaluating relationships with path models involving latent variables, as it enables the examination of complex frameworks and accommodates several types of variables without imposing restrictive assumptions (Hair *et al.,* 2019). Following Cohen's (1992) guidelines for multiple ordinary squares regression, a minimum of 54 observations is required to detect R^2 values of approximately 0.25, assuming a significance level of 5% and a statistical power of 80%. Given that the present study's sample consists of 74 cases, it meets the required criteria for data adequacy.

3.2. Variables

3.2.1. Dependent variable

The target variable is the firms' orientation toward the circular economy (OEC). To assess this construct, the respondents were asked to indicate their level of agreement with statements regarding their firm's engagement in EC practices. A 5-point Likert scale was used, ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). The measurement scale was adapted from Zeng *et al.* (2017) and contained ten items.

3.2.2. Independent variable

The explanatory variable is the perceived corporate social responsibility (PCSR). PCSR was evaluated based on respondents' perceptions of their firm's CSR practices. Specifically, respondents were asked to rate their level of agreement with a set of statements related to CSR initiatives. Responses were scored using a 5-point Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). The scale, adapted from Damberg *et al*. (2024), consisted of five items.

3.2.3. Moderating variables

The study incorporates isomorphic forces as moderating variables. To assess these forces, respondents were asked to indicate their level of agreement with statements related to institutional pressures faced by their firm within its industry/sector. Coercive isomorphism was measured using four items that assessed respondents' perceptions of formal consequences for firms that fail to comply with environmental regulations. Mimetic isomorphism was evaluated using three items that captured respondents' awareness of environmental initiatives undertaken by industry leaders. Normative isomorphism was assessed using three items that reflected collective industry norms regarding environmental practices. The measurement scales were adapted from Colwell and Joshi (2013), with all items rated on a 5-point Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree").

4. Results

4.1. Evaluation of the Reflective Measurement Models

The assessment of the measurement model follows the recommendations outlined by Hair *et al.* (2019). We report bias-corrected results obtained through the percentile bootstrapping approach, using 10,000 subsamples and a two-tailed 95% confidence interval for significance testing. The evaluation of the reflective measurement models includes an analysis of indicator reliability, internal consistency, convergent validity, and discriminant validity (Table 2). To ensure adequate indicator reliability, only outer loadings above 0.708 were retained in the analysis (Hair *et al.,* 2019). Internal consistency reliability was assessed using Cronbach's alpha (CA), composite reliability (CR) ρ_C, and Dijkstra-Henseler's ρ_A, all of which exceeded the recommended threshold of 0.7, confirming the reliability of the reflective constructs (Hair *et al.*, 2019).

Table 2: Indicator loadings, reliability, and convergent validity

Reflective constructs		Outer loadings	CA	ρ_A	CRρ_C	AVE
Coerc: Coercive isomorphism[1]			0.903	0.902	0.940	0.841
coer1	Firms in our industry that did not meet the legislated standards for pollution control faced a significant threat of legal prosecution.	0.958 [0.928; 0.975]				
coer3	If firms in our industry committed an environmental infraction, the	0.840				

	Reflective constructs	Outer loadings	CA	ρ_A	CRρ_C	AVE
	consequence would likely have included negative reports by industry/stock market analysts.	[0.717; 0.908]				
coer4	There were negative consequences for companies that failed to comply with environmental laws.	0.947 [0.914; 0.967]				
Mim: Mimetic isomorphism			0.823	0.834	0.894	0.739
mim1	The leading companies in our industry set an example for environmentally responsible conduct.	0.892 [0.828; 0.931]				
mim2	The leading companies in our industry were known for their practices that promoted environmental preservation.	0.854 [0.724; 0.919]				
mim3	The leading companies in our industry worked on ways to reduce their environmental impact.	0.832 [0.728; 0.898]				
Norm: Normative isomorphism			0.823	0.860	0.892	0.733
norm1	Our industry had trade associations (or professional associations) that encouraged organisations to become more environmentally responsible.	0.870 [0.812; 0.904]				
norm2	Our industry expects all firms to be environmentally responsible.	0.827 [0.689; 0.892]				
norm3	Being environmentally responsible requires firms to be part of this industry.	0.870 [0.751; 0.929]				
Orientation toward the circular economy (OEC)[2]			0.888	0.897	0.914	0.639
oec1	The firm is devoted to reducing the unit product manual input.	0.789 [0.647; 0.866]				
oec2	The firm is devoted to reducing the consumption of raw materials and energy.	0.741 [0.551; 0.843]				
oec3	The firm initiatively enhances the energy efficiency of production equipment.	0.844 [0.755; 0.897]				
oec4	Product packaging materials are used repeatedly.	0.778 [0.636; 0.868]				
oec5	Equipment cleaning materials are used repeatedly.	0.824 [0.635;				

	Reflective constructs	Outer loadings	CA	ρ_A	CRρ_C	AVE
		0.918]				
oec6	Leftover material is used repeatedly to manufacture other products.	0.816 [0.720; 0.882]				

[1] Excluded item from coercive isomorphism: coer2 – Firms in our industry were aware of the fines and penalties potentially associated with environmentally irresponsible behaviour.

[2] Excluded items from orientation toward the circular economy: oec7 – Waste produced in the manufacturing process is recycled; oec8 – Waste products from consumers are recycled; oec9 – Waste and garbage are reprocessed; oec10 – Waste and garbage are used after reprocessing to manufacture new products.

Source: Authors

Convergent validity was examined through the average variance extracted (AVE), with all values exceeding the 0.50 threshold (Fornell and Larcker, 1981), indicating that each construct explains a sufficient proportion of the variance in its indicators. Discriminant validity was assessed using the heterotrait-monotrait (HTMT) ratio of correlations (Henseler *et al*., 2015). As all HTMT values were significantly below one (Frank and Sarstedt, 2019), discriminant validity was established (Henseler *et al*., 2015). However, when applying the more conservative HTMT criterion (e.g., a threshold of 0.90), potential discriminant validity concerns arise regarding the constructs of OEC and coercive isomorphism, although this issue does not affect the other constructs.

Table 3: Discriminant validity

Reflective constructs	HTMT
Mimetic isomorphism <–> Coercive isomorphism	0.747 [$CI_{0.95}$: 0.858]
Normative isomorphism <–> Coercive isomorphism	0.742 [$CI_{0.95}$: 0.887]
Normative isomorphism <–> Mimetic isomorphism	0.733 [$CI_{0.95}$: 0.884]
OEC <–> Coercive isomorphism	0.917 [$CI_{0.95}$: 0.966]
OEC <–> Mimetic isomorphism	0.812 [$CI_{0.95}$: 0.929]
OEC <–> Normative isomorphism	0.848 [$CI_{0.95}$: 0.951]

Source: Authors

4.2. Evaluation of the Formative Measurement Model

A redundancy analysis was conducted to evaluate the formative construct of PCSR. The results indicate that the convergent validity of PCSR is established, as evidenced by the coefficient linking PCSR to its global measure, which is 0.825, exceeding the recommended threshold of 0.707 (Hair *et al.*, 2019). The assessment of the formative measurement model further revealed that the highest variance inflation factor (VIF) was 2.146 for pcsr3 (Table 4). Since all VIF values remain below the critical threshold of 5 (Hair *et al*., 2019), collinearity does not pose a concern. Additionally, the outer weights are significant, ranging between 0.191 and 0.334 (Table 4), further supporting the validity of the formative construct.

Table 4: Formative measurement results

Formative construct		Outer weights	Significant ($p < 0.05$)	VIF
PCSR: Perceived corporate social responsibility				
pcsr1	I believe my firm is not only interested in profit.	0.334 [0.270; 0.442]	Yes	1.519
pcsr2	My firm is also committed to preserving the environment.	0.236 [0.190; 0.291]	Yes	1.761
pcsr3	My main firm behaves responsibly toward society.	0.246 [0.206; 0.286]	Yes	2.146
pcsr4	I believe that my firm informs the public honestly.	0.191 [0.114; 0.246]	Yes	1.848
pcsr5	I believe that my firm behaves fairly toward its competitors.	0.298 [0.240; 0.398]	Yes	1.719

Source: Authors

4.3. Evaluation of the Structural Model

The structural model was evaluated based on the path coefficients and their significance levels. The model's explanatory power was first examined through the coefficient of determination (R^2), which indicated that the included variables accounted for 84.3% of the variance in the firms' OEC. Complementing the R^2 assessment, the effect size (f^2) was also considered, as it quantifies the relative impact of each independent variable on the dependent variable based on changes in R^2 values (Cohen, 1988). Following Cohen's (1988) classification, effect sizes are categorised as high ($f^2 \geq 0.35$), medium ($0.15 \leq f^2 < 0.35$), small ($0.02 \leq f^2 < 0.15$), and negligible ($f^2 < 0.02$). The results indicate that most effect sizes in the model fall within the high, medium, and small ranges. The collinearity assessment confirmed the robustness of the model, as all predictor variables exhibited VIF values below the recommended threshold of 5 (Hair *et al.,* 2019).

Table 5: Structural model relationships

Relationships	R^2	Path coefficient	Significant ($p < 0.05$)	f^2	VIF
Direct effects					
PCSR → OEC	0.843	0.311 [0.069; 0.506]	Yes	0.179	3.448
Coercive isomorphism → OEC		0.542 [0.385; 0.788]	Yes	0.532	3.519
Mimetic isomorphism → OEC		0.104 [-0.059; 0.254]	No	0.032	2.167
Normative isomorphism → OEC		0.108 [-0.087; 0.296]	No	0.020	3.690
Interactive effects					
PCSR × Coercive isomorphism → OEC		0.433 [0.308; 0.629]	Yes	0.423	4.545
PCSR × Mimetic isomorphism → OEC		0.059 [-0.134; 0.275]	No	0.008	3.981
PCSR × Normative isomorphism → OEC		-0.092 [-0.271; 0.160]	No	0.017	4.104

Source: Authors

Table 5 summarises the direct and interaction effects and their significance levels. The findings indicate that the perception of CSR is positively associated with firms' OEC (H1: beta value [β] = 0.311; $p < 0.01$), therefore, providing empirical support to hypothesis 1. The results also confirmed that coercive isomorphism has a direct and significant influence on OEC ($\beta = 0.542$; $p < 0.001$), while mimetic ($\beta = 0.105$; $p = 0.202$) and normative ($\beta = 0.108$; $p = 0.268$) isomorphism do not exhibit statistically significant effects on the target variable.

The analysis of interaction effects further reveals that coercive isomorphism enhances the positive relationship between PCSR and OEC (H2: $\beta = 0.422$; $p < 0.001$), thus supporting hypothesis 2. However, neither normative isomorphism (H3: $\beta = -0.092$; $p = 0.403$) nor mimetic isomorphism (H4: $\beta = 0.059$; $p = 0.567$) significantly interacts with PCSR to increase the SME orientation toward the circular economy. As a result, the theoretical assumptions underlying hypotheses 3 and 4 do not receive empirical support. We delve into the implications of these findings in the next section.

5. Discussion

The acceptance of hypothesis 1 confirms that perceived CSR practices, as framed within the TBL approach, serve as an effective mechanism for encouraging and facilitating firms' transition toward a CE as a sustainable business model (Gallardo-Vázquez *et al*., 2024). This finding aligns with prior research establishing a link between TBL and sustainable development (Jeurissen, 2000; Wiebe *et al.*, 2023). Scholars argue that implementing CSR practices can facilitate the adoption of CE principles by enhancing operational efficiency and improving firms' competitive positioning (Camilleri, 2022; Yu *et al*., 2017), which is implicit in validating hypothesis 1. Specifically, in the context of international SMEs, PCSR fosters a proactive commitment to sustainability, ethical responsibility, and stakeholder engagement. As these firms expand into international markets, they encounter diverse regulatory frameworks, consumer expectations, and competitive pressures that require the integration of sustainable business practices (Gonçalves *et al.*, 2024). Therefore, the alignment of PCSR with CE principles reinforces long-term value creation by balancing economic performance with environmental and social responsibilities, ultimately driving sustainable competitive advantage in international business environments.

Regarding the transition to CE practices through the lens of institutional theory, the proposed model was constructed based on the assumption that coercive, normative, and mimetic isomorphic forces influence CSR practices, as suggested by previous research (Bu *et al.*, 2023; Gallardo-Vázquez *et al*., 2024). The acceptance of hypothesis 2 confirms that coercive isomorphism plays a crucial role in advancing firms' CSR efforts toward sustainable development (Gallardo-Vázquez *et al*., 2024). The results indicate that coercive pressures significantly drive firms to adopt CE principles, supporting the argument that regulatory and stakeholder-driven enforcement mechanisms facilitate the transition to closed-loop production models (Daddi *et al*., 2021; Qi *et al.*, 2022). This shift is often encouraged by cost reductions (Kumar and Dua, 2022) and tax benefits (Gemechu *et al.*, 2014). More specifically, coercive isomorphism strengthens the positive relationship between PCSR and OEC in international SMEs by exerting regulatory and stakeholder-driven pressures reinforcing sustainable business transformations. Operating across multiple jurisdictions, these firms must comply with environmental regulations, trade policies, and sustainability reporting standards imposed by governments, supranational institutions, and industry regulators. Consequently, coercive forces create a structured institutional environment where adherence to CE principles is a

strategic advantage and a prerequisite for market access and legitimacy. These external pressures enhance the credibility and consistency of sustainability initiatives, ensuring that PCSR translates into substantive CE practices rather than symbolic commitments.

Conversely, hypotheses 3 and 4 were not supported, indicating that mimetic and normative isomorphic forces do not significantly strengthen the relationship between PCSR and OEC, despite previous research suggesting that such institutional pressures can foster corporate environmental responsibility (Bansal, 2005; Gluch and Stenberg, 2006). This finding is noteworthy, as prior studies propose that all three isomorphic forces contribute to firms' transition from a linear to a circular economy (Gallardo-Vázquez *et al*., 2024). However, the results of this study do not align with those expectations.

The non-significant effect of mimetic isomorphism on the PCSR-OEC relationship in international SMEs can be attributed to the heterogeneous adoption of CE practices across industries and markets. While firms may seek to imitate the sustainability strategies of successful peers to enhance legitimacy and competitive positioning, the extent to which they do so depends on contextual factors such as industry characteristics, resource availability, and the maturity of CE frameworks within their operational environments. Unlike coercive and normative pressures, mimetic influences operate informally, resulting in variability in adoption rates and implementation depth among SMEs. Furthermore, given SMEs' financial and technical constraints, replicating complex CE models from larger or more established firms might not always be feasible. While early-stage CSR firms can pursue strategies similar to those of their competitors in response to institutional pressures (Gallardo-Vázquez *et al.*, 2024), mimetic isomorphism lacks the consistency and enforcement mechanisms required to establish a substantial and statistically significant effect on the PCSR-OEC relationship.

Similarly, normative isomorphism's negative but statistically insignificant effect suggests that professional norms, industry standards, and sustainability-related educational frameworks do not uniformly reinforce CE adoption in international SMEs. While prior literature posits that normative pressure – arising from industry associations, professional networks, and sustainability-focused education – positively influence organisational environmental responsibility (Bansal, 2005; Gallardo-Vázquez *et al.*, 2024; Gluch and Stenberg, 2006), their impact on CE practices appears to be constrained by inconsistencies across industries and geographical regions. International SMEs often operate in diverse institutional contexts where normative expectations regarding sustainability vary, leading to fragmented or conflicting guidance on CE adoption. Additionally, SMEs may perceive industry standards as aspirational rather than obligatory, resulting in selective or superficial compliance rather than meaningful integration of CE principles. Given their resource limitations, SMEs might also prioritise adherence to coercive pressures over normative expectations, which are often less enforceable. This misalignment between theoretical expectations (hypothesis 4) and empirical findings suggests that, while normative isomorphism influences sustainability discourse, it lacks the direct enforcement mechanisms needed to consistently strengthen the PCSR-OEC relationship in international SMEs.

6. Conclusion

The study suggests that PCSR positively influences firms' orientation toward CE, with coercive isomorphic pressures significantly strengthening this relationship. Notably, neither

normative nor mimetic pressures showed significant moderating effects. These findings offer several important theoretical and practical implications.

From a theoretical perspective, the research on CSR practices and organisational commitment to the CE advances research on sustainable development. It establishes a meaningful link between PCSR and CE implementation, positioning PCSR as a valuable metric for assessing sustainable development within business management. Furthermore, this study contributes to institutional theory (Bansal, 2005; DiMaggio and Powell, 1983) by offering a nuanced understanding of how different isomorphic pressures influence the relationship between PCSR and OEC in international SMEs. The findings challenge the conventional assumption that coercive, normative, and mimetic pressures uniformly drive sustainability-oriented decision-making. Instead, the results highlight the dominant role of coercive pressures, emphasising the importance of regulatory and stakeholder-imposed orders in facilitating CE adoption. In contrast, the non-significant effects of normative and mimetic pressures suggest that their influence is highly contextual and varies across SMEs. These outcomes indicate that institutional theory should further differentiate between the varying degrees of influence exerted by different isomorphic forces, particularly in resource-constrained and internationally dispersed SMEs.

The study also has practical implications for firms, allowing them to assess their current position relative to their CSR practices in the CE transition. As international firms seek innovative approaches to environmental sustainability, they must continuously refine their value-creation processes to comply with evolving regulations and meet consumer expectations. Moreover, businesses increasingly promote environmental initiatives and engage in sustainability-driven leadership (Gonçalves *et al*., 2024). The findings emphasise the need for international SMEs to align their sustainability strategies with regulatory requirements and key stakeholder expectations, as coercive pressures play a pivotal role in strengthening PCSR-driven CE adoption. To achieve this, firms should proactively engage with policymakers, industry associations, and global supply chain partners to ensure compliance with sustainability regulations while leveraging CE initiatives as a source of competitive advantage. Additionally, SMEs should critically evaluate the relevance of normative and mimetic influences in their respective industries, adopting best practices that are both feasible and strategically beneficial.

These findings highlight the need for clearer, enforceable sustainability regulations that provide SMEs with structured incentives and compliance support. Beyond regulatory requirements, policymakers should focus on fostering industry-wide sustainability norms and facilitating knowledge-sharing networks that make normative and mimetic influences more actionable and impactful. By creating a balanced regulatory environment that combines enforcement with capacity-building initiatives, policymakers can strengthen institutional mechanisms that encourage CE adoption among international SMEs.

While this study provides valuable contributions, it is important to acknowledge its limitations, which open avenues for future research. The analysis focused exclusively on Portuguese international SMEs. Although this approach allowed for a more precise comparison with other small open developed economies, future research should extend the analysis to different geographical contexts to enhance the external validity of the findings. A comparative study incorporating both SMEs and larger international firms would also be beneficial in assessing whether the firm size influences the relationship between PCSR, OEC, and institutional pressures. Additionally, the sample size could be expanded to increase the

robustness and generalizability of the results. Future studies may seek a larger and more diverse sample to validate the proposed relationships further. Another limitation concerns the relatively short timeframe of data collection. The study relied on cross-sectional data, with responses collected simultaneously (reflecting three years from 2021 to 2023). This approach constrained the ability to capture the dynamic nature of PCSR, OEC, and institutional forces. To address this, future research could adopt a longitudinal design, gathering data at multiple intervals to understand better how these constructs develop and interact over time.

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REFERENCES

Azim, M. T. (2016): ***Corporate Social Responsibility and employee behavior: mediating role of organizational commitment*,** Review of Business Management, Vol. 18, pp 207-225.

Bansal, P. (2005): ***Evolving sustainably: A longitudinal study of corporate sustainable development,*** Strategic Management Journal, Vol. *26*, No. 3, pp. 197-218.

Bu, M. *et al.* (2023): ***MNEs' transfer of socially irresponsible practices: A replication with new extensions,*** Journal of World Business, Vol. 58, No. 2, 101384.

Camilleri, M. A. (2022): ***Strategic attributions of corporate social responsibility and environmental management: The business case for doing well by doing good!*** Sustainable Development, Vol. 30, No. 3, pp. 409-422.

Cohen, J. (1992): ***A power primer*,** Psychological Bulletin, Vol. 112, No. 1, pp. 155–159.

Cohen, J. (1988): ***Statistical Power Analysis for the Behavioral Sciences,*** Lawrence Erlbaum Associates.

Colwell, S. R., and Joshi, A. W. (2013): ***Corporate ecological responsiveness: Antecedent effects of institutional pressure and top management commitment and their impact on organizational performance*,** Business Strategy and the Environment, Vol. 22, No. 2, pp. 73-91.

Commission of the European Communities. (2001): ***Green Book. Foster a European Framework for Corporate Social Responsibility*,** Commission of the European Communities.

Courrent, J. M. *et al.* (2018): ***Do entrepreneurial SMEs perform better because they are more responsible?*** Journal of Business Ethics, Vol. 153, No. 2, pp. 317-336.

Daddi, T. *et al.* (2021): ***Institutional pressures on the adoption of environmental practices: a focus on European professional football***, Journal of Environmental Planning and Management, pp. 1-23.

Damberg, S. *et al.* (2024): ***Does culture matter? Corporate reputation and sustainable satisfaction in the Chinese and German banking sector*****,** Journal of Marketing Analytics, Vol. 12, No. 1, pp. 6-24.

De Zoysa, A., and Takaoka, N. (2019): ***Corporate social responsibility performance of small and medium enterprises in regional Japan: an empirical examination***, Social Responsibility Journal, Vol. 16, No. 4, pp. 449-466.

DiMaggio, P. J., and Powell, W. W. (1983): ***The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields*****,** American Sociological Review, Vol. 48, No. 2, pp. 147-160.

Dubey, R. *et al.* (2019a): ***Big data and predictive analytics and manufacturing performance: integrating institutional theory, resource-based view and big data culture*****,** British Journal of Management, Vol. 30, No. 2, pp. 341-361.

Dubey, R. *et al* (2019b): ***Supplier relationship management for circular economy: Influence of external pressures and top management commitment*****.** Management Decision, Vol. 57, No. 4, pp. 767-790.

Eid, M., and Loon, M. (2023): ***CSR as a capability-building response to exogenous shocks by Lebanese MNEs*****,** Journal of World Business, Vol. 58, No. 5, 101474.

European Commission. (2014): ***Communication from the Commission to the European Parliament, to the Council, to the European Economic and Social Committee and the Committee of the Regions, there was a circular economy: a zero waste program for Europe*****.** Retrieved 25 March 2025 from: https://eur-lex.europa.eu/legal-content/ES/TXT/?uri=celex%3A52014DC0398.

European Commission. (2015): ***User Guide to the SME Definition. Publications Office of the European Union, Luxembourg*****,** Retrieved 5 January 2023 from: https://op.europa.eu/en/publication-detail/-/publication/79c0ce87-f4dc-11e6-8a35-01aa75ed71a1.

Fornell, C., and Larcker, D. F. (1981): ***Evaluating structural equation models with unobservable variables and measurement error*****,** Journal of Marketing Research, Vol. 18, No. 1, pp. 39–50.

Fontoura, L. *et al.* (2023): ***Real-time energy flow mapping: A VSM-based proposal for energy efficiency*****,** Journal of Cleaner Production, Vol. 419, 137871.

Gallardo-Vázquez, D. *et al.* (2024): ***Circular economy orientation from corporate social responsibility: A view based on structural equation modeling and a fuzzy-set qualitative comparative analysis*****,** Sustainable Development, Vol. 32, No. 5, pp. 5581-5601.

Gemechu, E. D. *et al.* (2014): ***Economic and environmental effects of CO2 taxation: an input-output analysis for Spain*****,** Journal of Environmental Planning and Management, Vol. 57, No. 5, pp. 751-768.

Gluch, P., and Stenberg, A. C. (2006): ***How do trade media influence green building practice?*** Building Research & Information, Vol. 34, No. 2, pp. 104-117.

Gonçalves, R. *et al.* (2024): ***The impact of open innovation on the environmental sustainability practices and international sales intensity nexus: A multicountry study*,** International Business Review, Vol. 33, No. 5, 102279.

Hair, J. F. *et al*. (2019): ***When to use and how to report the results of PLS-SEM*,** European Business Review, Vol. 31, No. 1, pp. 1-25.

Henseler, J. *et al*. (2015): ***A new criterion for assessing discriminant validity in variance-based structural equation modeling*,** Journal of the Academy of Marketing Science, Vol. 43, No. 1, pp. 115-135.

Jawahir, I. S., and Bradley, R. (2016): ***Technological elements of circular economy and the principles of 6R-based closed-loop material flow in sustainable manufacturing***, Procedia Cirp, Vol. 40, pp. 103-108.

Jeurissen, R. (2000): ***Cannibals with forks: The triple bottom line of 21st century business*,** Journal of Business Ethics, Vol. 23, No. 2, pp. 229-231.

Jun, H., and Xiang, H. (2011): ***Development of circular economy is a fundamental way to achieve agriculture sustainable development in China*,** Energy Procedia, Vol. 5, pp. 1530-1534.

Khan, O. *et al.* (2020): ***Assessing the determinants of intentions and behaviors of organizations towards a circular economy for plastics***, Resources, Conservation and Recycling, Vol. 163, 105069.

Kumar, S., and Dua, P. (2022): ***Environmental management practices and financial performance: evidence from large listed Indian enterprises***, Journal of Environmental Planning and Management, Vol. 65, No. 1, pp. 37-61.

Larrán, M. *et al.* (2016): ***Measuring the linkage between strategies on sustainability and institutional forces: an empirical study of Spanish universities,*** Journal of Environmental Planning and Management, Vol. 59, No. 6, pp. 967-992.

Lozano, R., and Lozano, F. J. (2024): ***Developing a decision-making tree for circular economy***, Sustainable Development, Vol. 32, No. 3, pp. 1589-1598.

Nardella, G. *et al.* (2023): ***What happens abroad, stays abroad? Exploring how corporate social irresponsibility in domestic and international markets influences corporate reputation***, Journal of World Business, Vol. 58, No. 4, 101420.

Nsiah-Sarfo, D. J. *et al.* (2023): ***Sustainable procurement implementation among public sector organisations in Ghana: The role of institutional isomorphism and sustainable leadership.*** Cleaner Logistics and Supply Chain, Vol. 8, 100118.

Qi, J. *et al.* (2022): ***Bank managers' perceived importance of corporate environmental management in lending decisions: investigating institutional motivational factors*****,** Journal of Environmental Planning and Management, Vol. 65, No. 8, pp. 1436-1455.

Santiago, B. D. S. *et al.* (2025): ***Corporate social responsibility and circular economy integration framework within sustainable supply chain management: Building blocks for industry 5.0*****,** Corporate Social Responsibility and Environmental Management, Vol. 32, No. 1, pp. 269-290.

Schmidt, C. V. H. *et al.* (2021): ***Understanding the effect of market orientation on circular economy practices: The mediating role of closed-loop orientation in German SMEs****,* Business Strategy and the Environment, Vol. 30, No. 8, pp. 4171-4187.

Siueia, T. T. *et al.* (2019): ***Corporate Social Responsibility and financial performance: A comparative study in the Sub-Saharan Africa banking sector*****,** Journal of Cleaner Production, Vol. 226, pp. 658-668.

Wiebe, K. S. *et al.* (2023): ***Circular Economy and the triple bottom line in Norway*****.** Circular Economy and Sustainability, Vol. 3. No. 1, pp. 1-33.

Yu, H. C. *et al.* (2017): ***The relationship between CSR disclosure and competitive advantage****,* Sustainability Accounting, Management and Policy Journal, Vol. 8, No. 5, pp. 547-570.

Zeng, H. *et al.* (2017): ***Institutional pressures, sustainable supply chain management, and circular economy capability: Empirical evidence from Chinese eco-industrial park firms*****,** Journal of Cleaner Production, Vol. 155, pp. 54-65.

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SUSTAINABLE PROJECT ECONOMY IN THE DEVELOPMENT OF SMART CITIES

ABSTRACT

This research focuses on the role and potential of sustainable project economics in transforming local governments and business entities towards sustainable development and the concept of smart cities. Sustainable project economics, an integral part of contemporary project management theory, encompasses a synthesis of knowledge, skills, and tools to achieve strategic objectives within limited resources constraints. This paper aims to determine the scope and possible application of sustainable project economics in local units, particularly in transforming cities into smart cities. Through analyzing the process of managing local governments using the McKinsey 7S framework and the smart city concept, the research highlights the importance of applying project management knowledge in the necessary transformation of local government units. The research results indicate that implementing project management knowledge in local government can significantly improve the efficiency and effectiveness of public administration, especially in the context of sustainable development. Additionally, the principles of project economics contribute to the economic growth of local communities through the transformation of business processes and increased transparency. The research used the city of Slavonski Brod as an example, where the application of project economics in the context of smart city development was analyzed. The research utilized a survey among local government officials, which showed significant potential for improving resource management, time management, and communications, which could lead to greater efficiency in project execution. Also, the research identified key challenges in the internal leadership of local government, including the lack of a continuous economic development strategy and the need for greater digitization of administrative processes. In conclusion, the paper confirms that the introduction of project economics and the application of project knowledge enable the creation of sustainable and prosperous communities, thereby contributing to the development of smart cities. The proposed management model emphasizes the synergy between the public and private sectors, with the implementation of standardized practices that reduce dependence on political changes. The research suggests that sustainable project economics is not just a collection of project management knowledge but an aggregate of knowledge and practices that emerge from theories of economic development and project management.

Key words: *local government, project management, sustainable project economy, smart cities, ESG standards, McKinsey 7S framework.*

1. Sustainable development of local units

In many countries and urban areas, there is a growing trend towards the implementation of smart city strategies, which are perceived as a response to the complex challenges of urban sustainability, efficiency and quality of life. However, their applicability and usefulness depend on the specific local context, the level of institutional readiness and development priorities, therefore it is not justified to view the digital transformation of local units as a universal need. Many local administrative units have developed strategies for converting their cities into human-centred smart cities. There are increasingly complex demands in urban planning, traffic infrastructure, public transportation, water and energy supply, environmental protection, climate change adaptation, and sustainable waste management. All these factors necessitate the development of smart solutions for local administrative units. Management must be functional. Goals ultimately achieve strategic, controlling, and organizational outcomes at all levels (Weichrich and Koontz, 1998). Project economics and the application of project management knowledge, with the impact of project management on sustainable business operations in local government, can assist in transforming cities into smart cities (Aračić, 2023). "project management" (Omazić & Baljkas, 2005) denotes the applied knowledge, skills, tools, and techniques to project activities to achieve goals and meet the requirements set before the project by influential stakeholder groups.

Achieving the vision of a smart city implies caring for the preservation of available natural resources, continuous education, interaction, and development of awareness and innovation in all areas, which is possible only with the active role of local administrative units that actively support the concept of a smart city. A smart city is where traditional management becomes more efficient through digital solutions to benefit its residents and businesses. Based on the analysis of available sources, there is no universally accepted definition of a smart city (Bibri et al., 2024). "The purposeful connection of electronic-communication devices and the internet to reduce resource consumption and improve the quality of life in cities can be called a Smart City System" (Sarker, 2022). The evolution of continuous technological advancements constantly expands this term and its applications. A smart city transcends the mere use of digital technologies for better resource use, urban traffic networks, enhanced water supply and waste disposal facilities, and more efficient ways of lighting and heating buildings. It also means a more interactive and responsive city administration that gradually builds a smart city tailored to human needs, catering to both the ageing population and new generations of urban residents. Therefore, many regional and local administrative units endeavour to apply increasing projects and develop a project economy system to enable growth and development through an advanced financing system.

This paper aims to determine the scope and possible application of sustainable project economics and project knowledge in local units for the effective transformation to create a so-called smart city.

The research will test the hypothesis that the introduction of a sustainable project economy in the management of local self-government units contributes to greater efficiency, transparency and more successful implementation of smart city development strategies.

2. Sustainable Project Economy in Building Smart Cities

Providing an overview of existing efficiency levels and proposing enhancement measures allows for targeted changes towards improved efficiency (Babić et al., 2024). Management is a continuous process (Bennet, 1997) directed towards achieving organizational goals as efficiently as possible. It encompasses addressing the engagement of material, human, and financial resources, organizational structures, development, goal setting, and the selection of criteria for assessing organizational efficiency. Management sets standards, determines budgets, plans, controls, coordinates, leads, motivates staff, and makes decisions. Numerous definitions characterize project management. Project management integrates every necessary step to develop a project cycle to meet its goals (Moris, 1997). Cleland and Ireland (2002) view it as a series of activities performed in collaboration with project team members and other stakeholders during the project to meet the schedule, cost, and technical performance. Reducing these theories to a common denominator, it is evident that authors agree on four key areas defining management – process, goal achievement, efficiency, and limited resources. Following these definitions, project management and its categorical division of applicable knowledge have evolved.

The Law on Local and Regional Self-Government (2000) mandates local self-government roles that require knowledge and possession of managerial methods and skills. Tasks related to the management of settlements, spatial and urban planning, communal services, child care, social welfare, primary health care, education, culture and sports, consumer protection, environmental protection, fire protection and civil defence, transportation, and maintenance of public roads as well as issuing construction and location permits, among many other acts, demand certain knowledge from public administration employees to fulfil these demands. All of this is a sustainability priority.

Each of these requirements placed before local self-government is a project that should be implemented through the prism of the project life cycle to achieve greater efficiency and effectiveness. Local self-governments in project management are often latent, leaving the initiative to contractors, which often proves insufficient and thus generates long-term additional costs. Self-government and its capacities to lead and execute activities are the main issues. They often have inadequate territorial structure, excessive centralization of authority and resources, and inefficient internal management in local units.

The first point of action towards improving the efficiency of local self-government is to progressively align the Law on Local Self-Government with the European Charter of Local Self-Government, which, once ratified, mandates autonomy and "local sovereignty" that must not be compromised by any higher authority in any way.

Linkages to increased centralization and influence are also evident in assigning tasks to local self-government units, where confusion often arises in jurisdiction due to unclear legal provisions. Thus, in some cases, the jurisdiction remains ambiguous as to whether the tasks assigned to local government are within the transferred scope or fully under the jurisdiction of the local government unit. Enhancing local self-government units' efficiency is possible by applying project management knowledge for sustainable growth and development. Unlike traditional managed local self-government units with stable roles and long-term careers, project-based units operate in a dynamic, fast-paced environment where needs rapidly change. The methodology for applying project management knowledge in the comprehensive sustainable renewal of the economy of local units can be described by the phrase "project

sustainable economy." Project economy (Conforto, 2024) represents a paradigm shift in managing an organization and organizational challenges. A new project-driven mode of operation fosters project-driven and project-inspired actions. Recent research on managing hybrid projects indicates the increasing role of artificial intelligence (AI) in shaping the future of project management. AI helps project managers select the optimal combination of methodologies for each project, simplifies processes, reduces human errors, accelerates the adoption of hybrid methods, and optimizes combinations used for complex projects. As AI tools become increasingly sophisticated, project managers must stay ahead by learning how to use these technologies effectively. AI-driven project management platforms such as Jira and Trello facilitate real-time collaboration and management of hybrid projects among teams, reducing delays and enhancing communication.

Research conducted within this paper argues that the purpose is not solely in projects when discussing project management but in the actual change of organizational thought. The existing definition of project economy indicates a paradigm shift, i.e., established practices in the organizational system. "Project economy as a principle is an enhancement of existing management practices aimed at fully integrating project management practices and knowledge absorbed into the organizational thought culture, changing the managerial mindset, and leading to a new paradigm of facing challenges" (Aračić, 2023).

A sustainable economy is a unique project approach to business that balances and addresses a project's environmental, social, and economic aspects to effectively respond to current stakeholder demands (Roška, Merkaš, Šavor, 2023).
Each local self-government that aims to be a smart city or place (municipality) achieving Smart City goals must realize six so-called smart areas: leadership, economy, environment, living, mobility, and people. That aims to encourage a complete transformation of the locality through more extensive and effective use of digital technologies and changes in management and planning, placing citizens at the core of urban, economic, and political centres. Altunbey et al. (2023) investigated to what extent the concept of a smart city enables more efficient use of its resources and provides better services to its residents. Their study explores smart practices in the City of Kashiwanoha, Japan, which is undoubtedly one of the best examples of a smart city in the world. "The study showed that smart ecological applications are designed to improve citizens' quality of life and ensure the city's sustainability. Smart environment applications in the smart City of Kashiwanoha include smart mobility, smart technology, smart governance, smart economy, smart life, and a smart environment based on transportation, energy, and environment." The researchers concluded that integrating blockchain technology could address urbanization challenges in smart cities' sustainable development. Research (Gorgol, 2023) exploring the smart city's physical structure confirmed that its spatial dimension can also be valued and measured. The main goal of the research was to develop a method for assessing the spatial dimension of the smart city. The methodology was based on comparative and interpretative analysis of logical argumentation based on analysis and synthesis. Thus, a tool for measuring and evaluating urban form can be applied to future smart city projects. From the vast range of previous research related to the development of the smart city concept, the prerequisite for a sustainable and transparent city necessitates the integration of a project-sustainable economy, i.e., effective use of project management knowledge areas.

It is essential to meet the criteria embedded in environmental, social, and governance (ESG) factors. Project management expertise is necessary for implementing the above-mentioned conditions. For example, environmental factors necessitate adapting production processes using recycled raw materials, converting production facilities to be more energy-efficient, and

implementing waste management policies to reduce environmental pollution. Social factors will require applying knowledge in managing human resources, communications, time, and quality. Governance factors, on the other hand, will imply the application of knowledge in risk management, integration, scope, cost, and procurement. The entire spectrum of project management knowledge is necessary in daily operations. The applicability of project management knowledge in local government is unique due to the nature of its tasks. Regardless of the specificities of local government, project economics can be utilized in city and local government management.

Key public administration problems (Koprić, 2016) are in four groups: orientation, organization, motivation, and implementation. Research by Osmanagić Bedenik (2018) on the possibility of introducing control in Croatian public administration using a municipal example concludes that there is a need for better financial reporting, human resource management, risk management, and the introduction of quality performance indicators. To further the research on the application of sustainable project economics knowledge, investigate the maximization of public officials' capabilities, the genesis of their work outcomes, and the disparities between budget projections and actual project implementations. Public administration goals are general; success is a cumulative avoidance of mistakes, proper and economic resource use is secondary, while hierarchical accountability is exceedingly clear with limited delegation capacity (Farnham & Horton, 1996).

A sustainable economy as an economic model enables long-term development with the conservation of natural resources, social justice, and economic stability. Through the sustainable economic model, local government units strive for sustainable resource management by introducing a circular economy, using renewable energy sources, and developing ecological agriculture. Through educational programs, further activities include green infrastructure, transportation, and social sustainability. Such an approach ensures the long-term development of local government units, balances economic, environmental, and social factors, and enhances the quality of life of their citizens.

Sustainable project economics is increasingly positioned as a key part of contemporary project management theory and practice, considering the integration of environmental, social and economic aspects in all phases of the project cycle. Leading international standards, such as A Guide to the Project Management Body of Knowledge (PMBOK® Guide), emphasize that sustainability should be an integral part of strategic planning and project management (Project Management Institute, 2021). Furthermore, Turner (2009) points out that successful project management requires balancing the short-term goals of the project with the long-term interests of the community and the environment, thus positioning sustainability as a fundamental value in the project economy.

"Sustainable project economy" means a modern approach to management that integrates the knowledge, skills and tools of project management with the principles of sustainable development (ecological, social and economic). It is about building on existing management practices that enables local governments and business entities to use resources more efficiently, increase transparency and achieve long-term development goals through project-structured processes. This concept implies the complete integration of project management knowledge into organizational culture and management mentality, thereby achieving a new paradigm of responding to the challenges of sustainability in urban development.

The main objective of this study is to explore the extent to which "sustainable project economics" is a necessary enhancement of existing management practices in local government units. This enhancement aims to integrate project management practices and knowledge that must lead to new paradigms in addressing ecological challenges.

3. Methodology

The study investigates the scope and possible ways of applying the concept of sustainable project economics, which encompasses principles of sustainable business and areas of project management knowledge with the goal of economical, efficient, and effective application in local government units for the ongoing transformation into smart cities.

The research methodology is based on a qualitative study conducted in 2023 in the city of Slavonski Brod (Plusportal, 2023). The survey technique was used among 40 city administration employees. The sample was selected purposively, and the surveys were targeted within departments related to city management. The analytical procedure includes a descriptive analysis of the responses and the application of McKinsey's 7S model in the interpretation of the results in the context of a smart city strategy.

Research conducted (Plusportal, 2023) showed that 74% of respondents believe the City Administration could more effectively handle citizens' complaints and requests. Regarding sports development and its potential to maximize tourist visits, 57% of respondents view it as an optimistic way to create a distinctive identity. Opinions are divided among respondents regarding the transparency of information on the current status of projects. Regarding the need for younger and more educated modern politicians, 88% agree that such leaders are necessary, aligning with the increasingly prevailing view in the Republic of Croatia. 59% of citizens believe that the economic condition of the City of Slavonski Brod depends mainly on the central government. Regarding public money spending, 69% believe that the city does not use funds based on principles of sensibility and economy, which relates to the general awareness of citizens about current matters.

A survey helped to analyze the current state and verification of the management model. The survey involves 40 city officials in Slavonski Brod who are directly involved in city management (Aračić, 2023). The relevance of the survey lies in evaluating the quality of work and human resources associated with managing the human resources of the project, time, scope, communications, and principles applicable in the day-to-day operations of public administration.

The study examining the efficiency of this model among public administration officials reveals that the City Administration of Slavonski Brod is relatively efficient in handling citizens' requests in system-related categories. Frequently, obstacles to more efficient resolution of requests arise from demands from superiors, resulting in a loss of continuity and disruption in weekly activity planning. The cause of these issues largely lies with the public officials; 55% acknowledge frequent disputes, intolerance, and covert or overt conflicts. Moreover, many surveyed officials are familiar with the operations of other departments and are willing to assist colleagues, expecting that such collegiality should be financially rewarded, a practice generally not adhered to, thus further intensifying an atmosphere of inertness.

A new vision for Slavonski Brod for the period 2021 to 2027 is aimed at focusing the city on sustainable development and high quality of life for all citizens or as a smart city grounded in science and education, emphasizing the University and linking the education sector with the economy; sustainable city development through strengthening the economy and economic activities; implementing new technologies and smart solutions in city management and basic urban infrastructure while taking care of the environment and improving citizens' health and social services.

Collected data were analyzed using the McKinsey 7S framework through a smart city strategy lens to determine how local government units utilize project management knowledge areas throughout the life cycles of executed projects. The results show the level of and usage of project management knowledge in local government and business entities. The research presents a model concept through which the local government unit, exemplified by Slavonski Brod, positions itself as a sustainable city developing according to smart city principles. Suggestions for strengthening sustainable business development based on guidelines and project management knowledge refer to business entities operating in the locality.

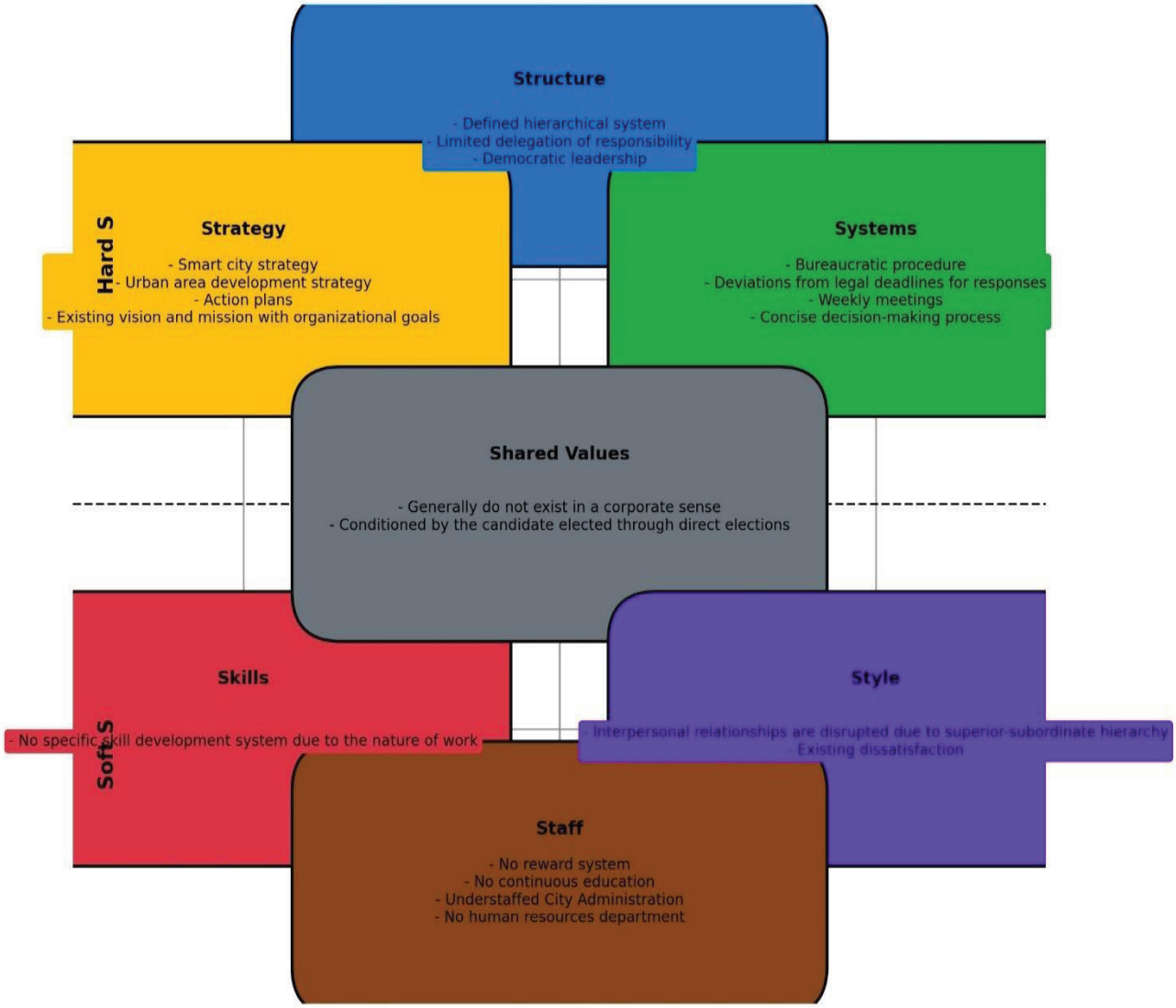
4. Empirical Research Results

As a starting point for evaluating integrated project management knowledge within the organizational structure of local government, specifically in the City of Slavonski Brod, we employed the McKinsey 7-S Framework (Waterman and Peters, 1982). Our focus areas included strategy, structure, systems, staff, skills, style, and shared values. The results of this analysis leverage the McKinsey 7S framework to relate to the internal organization and identify the general strengths, weaknesses, and opportunities within the City Administration, from which we can deduce the applicability of project management knowledge areas.
The 'Smart City' analysis relates to the outcomes or overall success of project implementations envisioned in the amendments to the Budget Decision for the City of Slavonski Brod for 2024, with projections for 2025 and 2026.

The survey analysis and development strategy use the McKinsey 7S framework viewed through the smart city concept lens. A strategy for economic development in Slavonski Brod made for 2012-2020. Since then, no new strategies have been developed, pointing to the recycling of the existing ones or an internal strategic development of the city without a publicly visible written plan. A novel element is the Smart City strategy for Slavonski Brod for 2021-2027, designed for the new Multiannual Financial Framework period and the implementation program related to this strategy, along with the Urban Area Development Strategy of Slavonski Brod for the financial period 2021-2027 and its Action Plan. The structure of the local government consists of the mayor's function, administrative departments and four subsections. Systems representing the business and technical infrastructure indicate the level of informatization or digitization within the local government. Bottlenecks in administrative processes consist of demands and their fulfilment. Digital transformation or digitalization has not reached the necessary level to meet contemporary administrative needs. A particular bureaucratic procedure for the reception of requests in the registry and their final resolution by officials prolongs the realization process. According to the 7-S framework, the' staff' element includes talent management and overall human resources associated with the decision-making process through the training, employment, and rewards system. Our local government does not utilize a system of rewards or training in the corporate sense of the word, which would entail continuous education and greater efficiency and effectiveness of the work. The assumption is that the monotony of public

service jobs gives an impression of security and enough time for effective work, which many public officials succumb to.

Graph 1: City Management Model Based on the McKinsey 7S Framework



Source: Authors

Regarding employment, there is a chronic shortage of officers despite constant recruitment drives. Although the local government unit is part of the bureaucratic system, there is a necessity to establish a human resources department that would continuously monitor quality, manage training systems, perform employment selections, resolve civil disputes in good faith, and promote the introduction of a rewards system as well as recognition of employees deserving of performance bonuses enabled by Article 13 of the Law on Salaries in Local and Regional Self-Government. The skills of the local government unit in Slavonski Brod imply how much growth, development, and career advancement opportunities there are for the officials. The personal development issue very often considers the lower-level officials' tasks. However, higher-placed officials also lack opportunities for growth and development, often lacking insured time to achieve departmental goals due to ad-hoc measures aimed at maintaining a good image of the administration. 'Style', a part of the framework for analysis, represents the culture

established within the company. In this case, it refers to the relationship between the highest and middle management towards lower-level officials as part of the soft skills element of management. It is well known that interpersonal relationships within the public administration are often disturbed due to the vertical superior-subordinate dynamic. Treatment towards lower-ranked officials, as well as among middle management (department heads), is often the primary reason for creating an atmosphere of dissatisfaction and disrespect. 'Shared values' are generally absent in the local government in a corporate sense. Bureaucracy demands the fulfilment of administrative and other requirements while possessing values that remain more or less at the discretion of leadership elected in direct elections every four years. However, local government could transform this 'dark matter' into collegiality and professionalism that would reign among officials based on an ethical code by defining a clear mission and vision.

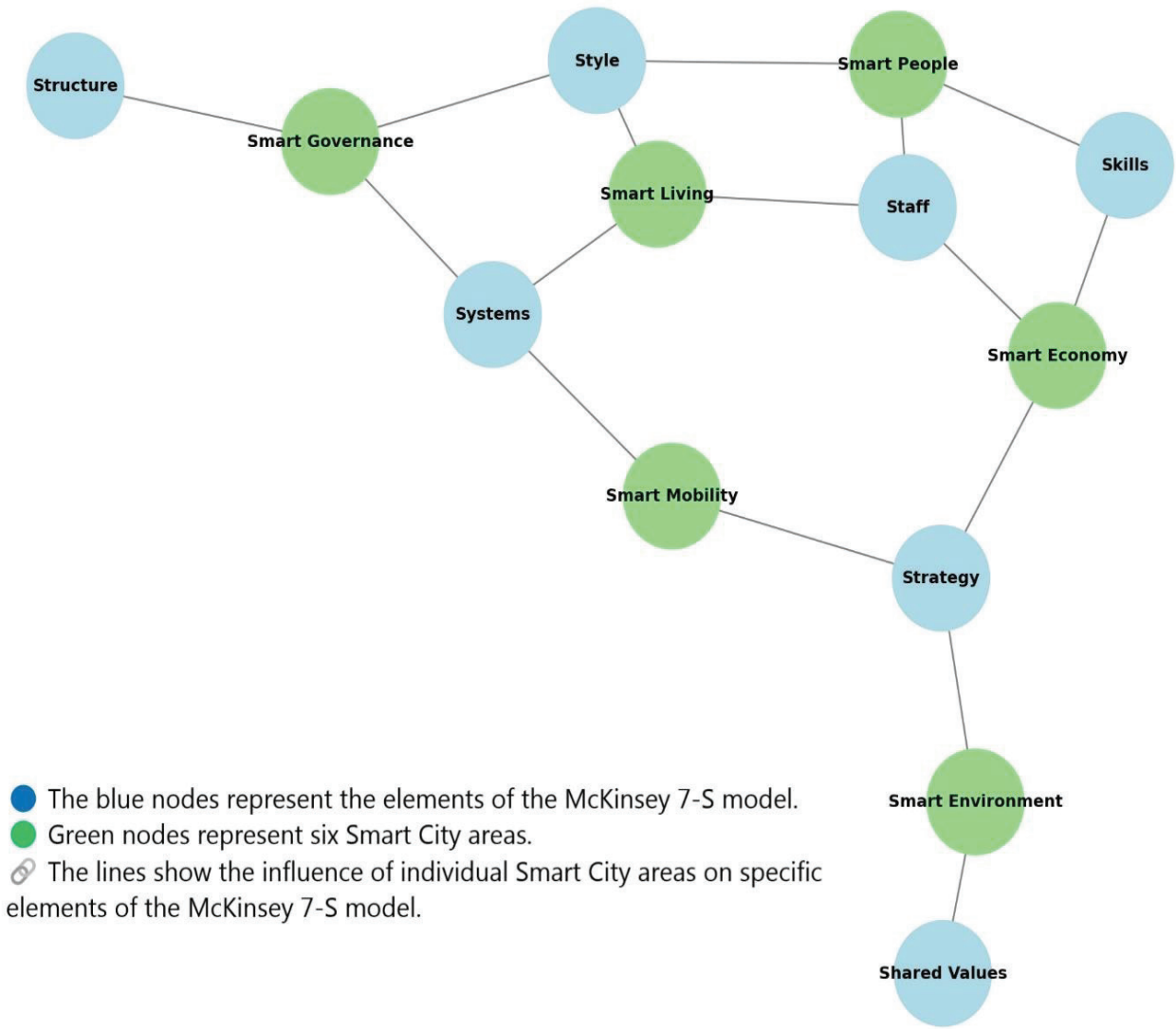
The concept of a Smart City has been analyzed for the existing conditions in the City of Slavonski Brod across six domains (management, economy, mobility, environment, lifestyle, and people), which together form the strategy for a smart city. This analysis is based on the 2024 Budget Decision for the City of Slavonski Brod and projections for 2025 and 2026. The study dissects budget heads, programs, activities, and capital projects, assigning them to the concept's corresponding pillar, which, through percentage values, expresses budget orientation toward the Smart City concept. The categorization of budget positions according to the Smart City pillars does not exclusively imply transformation positions but also positions concerning proper management techniques and the enrichment of the locality aligned with smart city principles. In the management sector, 0.45% of the budget must ensure transparent governance and community participation in decision-making. This allocation focuses on developing digital services for citizens, internal networking within the City Administration, and other components such as radio programming, newsletter printing, and various forms of promoting city projects and operations.

Economic development, the second pillar of the Smart City concept, is supported by 1.20% of the budget. These funds foster innovation and entrepreneurship by constructing a business accelerator, developing entrepreneurial zones including research and conservation work, subsidizing the InnoBrod business incubator, and further investments in the Center for Creative Industries. Eighty per cent of these funds are reserved until proposed projects are approved through integrated territorial investments.

Mobility receives the second-largest budget allocation at 13.6%. Much of this funding is toward capital projects such as constructing bicycle infrastructure, upgrading and modernizing municipal facilities incorporating new traffic solutions, and the continual replacement of public lighting. These investments support the enhancement of local accessibility and sustainable, innovative, and safe transport systems, and by building a new bus station, they enhance both international and local accessibility.

For environmental initiatives in 2024, the city plans to invest 9.91% of the budget. Most allocations target projects aimed at reducing pollution and protecting the environment. Year-round planting activities, green areas landscaping, and establishing a Botanical Garden are intended to reduce CO_2 emissions. Furthermore, the provision of free public transportation aims to decrease the use of personal vehicles, with the waste management policies yielding positive results as more than 1,500 tons of mixed municipal waste were collected from the start of 2023 to the summer of 2024 due to a new waste separation policy in households, saving the city from penalties for non-separation of waste.

Graph 2: City management model based on the McKinsey 7S framework through the lens of the Smart City strategy.



Source: Authors

Quality of life enhancement is the most supported budget item at 46.22%. The focus here is particularly on cultural and educational institutions, aiming to ensure, for instance, that all primary schools operate on a single-shift system. Expansions and new construction of daycares guarantee enrollment for all children in the city, with additional 2024 allocated to subsidize daycare services for all children fully. Constructing housing for young families is a unique measure of ensuring affordable living options and potential property buyouts with included rent payments. Through these and other budget items, the city addresses all aspects of smart living, including cultural institutions, personal security, housing quality, educational facilities, tourist appeal, and social cohesion.

The people category of the Smart City concept in the budget of the City of Slavonski Brod is supported with 0.95% of the total budget. This funding primarily enhances the quality of citizen participation in public life and co-finances science and higher education.

Sustainability, efficiency, and high quality of life planning through these six fields of action or specific city aspects explore how smart initiatives impact the achievement of the smart city strategy goals. A smart initiative or project becomes smarter as it utilizes project management knowledge and as the number of active fields increases. The budget allocation across these six key fields shows the planned level of enhancing the city's sustainability, efficiency, and quality of life. As a stand-alone field, technology facilitates project efficiency enhancements, while information and communication infrastructure, though crucial, are merely prerequisites for realizing established goals. Developing a smart city strategy requires genuine engagement and readiness for collaboration among institutions, the private sector, and citizens. Within each dimension (for example, according to the ASCIMER Good Practices Guide), fields of action can be broadly or narrowly defined, with possible specific smart initiatives/projects. The ongoing development and sustainability of the City of Slavonski Brod should result from a smart combination of new technologies, integrated platforms, modern infrastructure, new digital service designs based on the needs of citizens and business people, and the linking of smart mobile networks and networked devices, as illustrated in Graph 2 by the McKinsey 7S framework-based city management model

The scientific contribution of the work is reflected in the operationalization of the concept of sustainable project economy in the context of local self-government, through the application of the McKinsey 7S framework and the smart city. The paper contributes to the development of a theoretical framework that connects the knowledge areas of project management with the goals of sustainable development in an urban context, offering a model applicable to local units. The empirical part of the paper confirms the usefulness of such an approach and opens up possibilities for further research and comparisons.

The research results presented through a model reveal the weaknesses of the local government in Slavonski Brod in the internal governance segment. The absence of a concise economic development strategy contributes to the city's diminished attractiveness as a suitable business area. The lack of a variety of e-services provided by the City Administration results in a negative perception of the bureaucratic process, especially concerning the issuance of building and usage permits. Furthermore, a survey among officials indicates a certain complexity in relationships, which is the issue of a human resources department.

Local government management has shown continuous and reasonable investment aligned with the Smart City concept, accounting for 72% of the budget. Over the past few years, Slavonski Brod is Croatia's greenest and cleanest city. Additionally, the city has over 70 parks and plans to build a Botanical Garden soon. Demographic measures and policies targeting youth have resulted in a higher birth rate, while the development of cycling infrastructure promotes smarter mobility.

The applicability of sustainable economy projects in local government and business entities reflects the ideology of management by projects. The process involves changing work methods, thinking, and consciousness. Thus, the sustainable project economy becomes a principle and an enhancement of existing management practices aimed at fully integrating project management practices and knowledge into the local management unit's culture, significantly changing the managerial mindset and leading to a new paradigm for meeting challenges. Consequently, applying project management knowledge can elevate management efficiency levels. Project scope management knowledge identifies, evaluates, and structures project goals. Such knowledge is essential in daily decision-making concerning goal management. Knowledge of project resource management is crucial for participants in management to achieve better

outcomes and actualize established activities. Knowledge of project time management is a unique asset that, in synergy with other knowledge, results in timely activities that meet requirements. Local government can employ this knowledge in planning weekly activities, where each official manages individually and receives financial incentives for perseverance based on these. Knowledge of cost management in local government is vital in compiling the annual budget, which can be made based on a zero-based budgeting approach to trim unnecessary costs or overestimated positions that are poorly executed by year-end.

On the other hand, business entities use this knowledge to maximize annual profits and ensure sufficient solvency. Quality management is critical for the City Administration in the segment of public tenders. Many public tenders in the Republic do not define the quality level they wish to achieve in remediation, reconstruction, or construction projects.

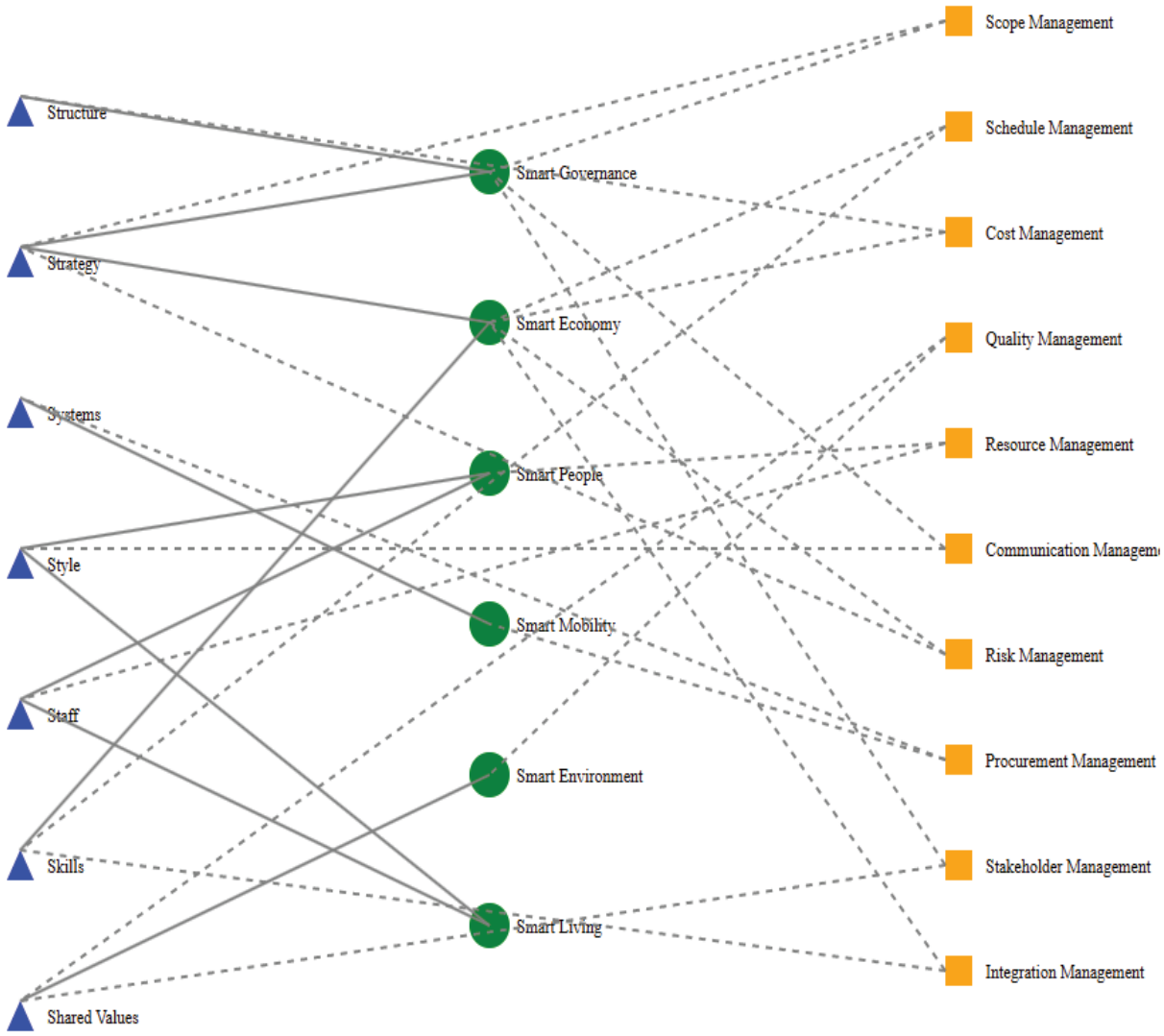
Most local governments demand cost-effectiveness at the expense of quality and durability that quality ensures. Entrepreneurs predominantly use this knowledge in producing their products or services, less so in regular business operations within the business culture. Human resource management in local government is unjustifiably overlooked, given that hiring occurs through public competitions that employ the most theoretically and experientially knowledgeable candidates rather than teamwork-oriented individuals with high ethical standards, as confirmed by a survey among officials. The reward system should additionally promote excellence among officials, and the introduction of a monthly activity plan in the citizen request resolution segment, based on the weighted arithmetic mean of time needed to resolve a certain number of requests per month, should not be neglected. Knowledge of communication management is likely the most significant obstacle in local governments for successful operations, as leaders are often characteristically authoritative, reducing subordinates to bureaucratic task execution, which many officials find dissatisfying and become inert, knowing they are unlikely to be dismissed. Furthermore, managing communications can also be used in devising methods of informing citizens to achieve a more approachable or "closer" administration. Lastly, project risk management knowledge in local governments can serve to identify and manage risks to all economic growth factors.

Overall, project management knowledge can be utilized in everyday activities, emphasizing the connective tissue that could be formed from the so-called "Vroom-Yetton-Jago normative decision-making model" (Lührs, Jager, Challies, 2018). The relevance of this model is reflected in the delegation of responsibilities absent in local government, which would reduce bureaucratic processes, and in business entities, promote collaborative decision-making not present in authoritative entrepreneurs who fail to recognize the strength of employees and teamwork, nor the benefits of reducing the burden of business decision-making as demonstrated in Graph 3.

This graph showcases the interconnection between elements, illustrating how knowledge of project management, based on conducted research, can influence the transformation and improvement of Smart City elements through the McKinsey 7S model in this specific local government unit. The elements of the McKinsey 7S model are indicated by triangles, elements of the Smart City concept by circles, and project management knowledge by squares.
Observed changes based on the city evaluation concept (IMD, 2024) should be primarily in the management efficiency of smart cities. Globally, as the world continues to change rapidly and faces increased uncertainty, cities are becoming hubs for new solutions and methods that prepare us for a future in a world of digital inequality. According to the 2024 IMD Smart City Index, key research data was on structures and technologies in five crucial areas: health and

safety, mobility, activities, opportunities, and governance. Research on the development of top-rated smart cities can yield ideas for urban development projects and enhance the quality of life by achieving project goals through the identification, classification, and execution of these projects. Such a document must define key areas of knowledge that local and regional governments must utilize. That approach will standardize the management and resource allocation process, ensuring the quality of public administration operations.

Graph 3: The impact of project management knowledge on transformation and improvement Smart City elements through the McKinsey 7S model



Source: Authors

The scientific contribution of the work is reflected in the operationalization of the concept of sustainable project economy in the context of local self-government, through the application of the McKinsey 7S framework and the smart city. The paper contributes to the development of a theoretical framework that connects the knowledge areas of project management with the goals of sustainable development in an urban context, offering a model applicable to local units. The empirical part of the paper confirms the usefulness of such an approach and opens up possibilities for further research and comparisons.

5. Conclusion

The research indicates that project economy represents a dynamic evolutionary process in which local government can achieve developmental goals, and enterprises can maintain responsible, sustainable operations by employing project management as a mode of operation, living, and understanding. The term project economy encapsulates the significance of project management as a comprehensive body of knowledge, emphasizing daily task execution and project leadership.

The study highlights a discrepancy between public opinion survey results and transparent management, which could imply political inertia among the local population, aligning with local election turnout percentages. The inquiry into the application of project management knowledge and principles of sustainable business in local government units and business entities, and how its application reflects on the economic development of localities, demonstrates that these areas of project management knowledge and their practical impact have considerable potential in achieving the developmental goals of local governments and enterprises. Sustainable project economy thus represents a synergy of knowledge and the will of those committed to changing work practices by leveraging project management knowledge to benefit local and business development.

This work confirms that applying project management knowledge or introducing a sustainable project economy in local government units and business operations is a prerequisite for political effectiveness and economic and commercial growth and development. The research suggests that a sustainable project economy is not merely a collection of project management knowledge but an entirety of knowledge and practices derived from development economic theories and project management. The proposed standardized processes based on project management aim to enhance the efficiency of local governments and business entities.

The limitations of the research arise from a relatively small sample size. Further research should employ various methodological approaches on a larger, more dispersed sample. The obtained results can serve as guidance. They are sufficiently indicative for a better understanding of the different aspects of using sustainable project economy knowledge in management and sustainable growth that local government units can apply.

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REFERENCES

Aračić, D. (2023): ***Projektna ekonomija i primjena znanja projektnog menadžmenta u lokalnoj samoupravi***. Diplomski rad. Zagreb: Međunarodno sveučilište Libertas.

Babić, A., Arbula Blecich, A. ., & Dukić Samaržija, N. (2024): ***Smart City Efficiency Assessment Model: Multi-Criteria Analysis Of 127 Croatian Cities.*** Ekonomski vjesnik/Econviews - Review of Contemporary Business, Entrepreneurship and Economic Issues, 37(2), 379–391. https://doi.org/10.51680/ev.37.2.11

Bennett, R. (1997): ***Management***. Third Edition. Pearson Education Limited: Velika Britanija, Available at: https://archive.org/details/management0000benn_k9s6/page/n5/mode/2up?view=theater

Bibri, S. E., Krogstie, J., Kaboli, A., & Alahi, A. (2024): ***Smarter eco-cities and their leading-edge artificial intelligence of things solutions for environmental sustainability: A comprehensive systematic review.*** Environmental Science and Ecotechnology, 19, 100330

Buble, M. (2010): ***Projektni menadžment***. Dugopolje: Minerva – Visoka poslovna škola

CFI Team (2023): ***McKinsey 7S Model: A tool that analyzes a company's "organizational design".*** Kanada: Corporate Finance Institute®. Available at: https://corporatefinanceinstitute.com/resources/management/mckinsey-7s-model/

Cleland, D. I., & Ireland, L. R. (2002): ***Project Management: Strategic Design and Implementation (4th ed.).*** New York, NY: McGraw-Hill. Project Management – Strategic Design and Implementation. Fourth edition. New York: The McGraw-Hill Companies

Conforto E. (2024): ***Project Management Institute, Inc***., du Cange, et al. (18831887) Glossarium mediae et infimae latinitatis. Niort: L. Favre, t. 6, col. 527c.

Dumančić, M., Babić, K., Milić, Ž. (2014): ***Projekt u oblaku***. U: Šiber, G. (ur.) Menadžment: zbornik radova. Zagreb: Visoka škola za poslovanje i upravljanje, s pravom javnosti „Baltazar Adam Krčelić", p. 60-61

Gorgol, N.K. (2023): ***Mjerenje prostorne dimenzije pametnog grada: novi alat za mjerenje i procjenu urbanog oblika pametnog grada***. Tehničke transakcije, 2023, Sciendo, vol. 120 br. 1,

Government of Ireland (2022): ***Public Service Project Management (PM) Handbook***.

HGK (28.3.2024): ***ESG i obveze i prilike u izvještavanju o održivosti.*** https://mint.gov.hr/UserDocsImages/2022_odrzivi_web/3__240404_ESG.pdf

IMD (2024): ***Smart City Index 2024***, https://www.imd.org/smart-city-observatory/home/

Ivanišević, S. (1999): ***Glavni problemi i mogući pravci reforme lokalne samouprave u Hrvatskoj***. Hrvatska javna uprava, 1(3), p. 587 – 598.

Koprić, I. (2016): ***Reforma javne uprave u Hrvatskoj: ni bolni rezovi ni postupne promjene – nužna je nova upravna paradigma***, Političke analize, 7 (26), p. 3 - 12.

Kreitner, R. (2009): ***Management. Eleventh Edition***. Boston: Houghton Mifflin Harcourt Publishing Company

Liang, Y., Ying, R. & Liu, P. (2013): ***Srednji softver na razini aplikacije temeljen na modelu za dizajn bežičnog pametnog grada.*** International Journal on Smart Sensing and Intelligent Systems, 2013, Sciendo, vol. 6 br. 3, p. 1180 - 1199

Lührs, N., Jager, N.W., Challies, E. et al. (2018): ***How Participatory Should Environmental Governance Be? Testing the Applicability of the Vroom-Yetton-Jago Model in Public Environmental Decision-Making***. Environmental Management 61.

Moris, P. (1997): ***The Management of Project***. London: Thomas Telford Publishing In Buble, M. (2010) Projektni menadžment. Dugopolje: Minerva – Visoka poslovna škola

Omazić, M. A., Baljkas, S. (2005): ***Projektni menadžment***. Zagreb: Sinergija nakladništvo.

Osmanagić B., N., Mikić, M. (2018): ***Mogućnost uvođenja kontrolinga u hrvatsku javnu upravu na primjeru općine***. EFZG serija članaka u nastajanju, 18(05)

Project Management Institute. (2021): ***A Guide to the Project Management Body of Knowledge (PMBOK® Guide) (7th ed.).*** Newtown Square, PA: Project Management Institute.

Sarker, I. H. (2022): ***Implementacija sustava pametnih gradova u Srbiji – osvrt na ulogu prometne struke***. Journal of Urban Technology, 29(3), 45-62.

Smart city strategija Slavonskog Broda 2021 -2027, Apsolon strategija d.o.o.

Turner, J. R. (2009): ***The Handbook of Project-Based Management: Leading Strategic Change in Organizations (3rd ed.).*** New York, NY: McGraw-Hill.

Udruga za projekt menadžment, PMI ogranak Zagreb (2007): ***PMI combined standards glossary: Lokalizirana verzija – Hrvatski*** [online]. Zagreb: MATE d.o.o: https://www.pmi-croatia.hr/static/uploaded/Files/COMBINED_STANDARD_GLOSSARY_LOKALIZIRANA_VERZIJA_HRVATSKI.pdf

Weichrich, H., Koontz, H. (1998): ***Menedžment***. Zagreb: MATE d.o.o.

Zakon o lokalnoj i područnoj (regionalnoj) samoupravi, Narodne novine 33/01, 60/01, 129/05, 109/07, 125/08, 36/09, 36/09, 150/11, 144/12, 19/13, 137/15, 123/17, 98/19, 144/20

Zucker, R. (2022): ***How To Succeed In A Project Economy***. Forbes [online], https://www.forbes.com/sites/rebeccazucker/2022/01/11/how-to-succeed-in-a-project-economy/?sh=1d45b69028d9

A scientific paper

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THE POST-TRANSITION TRAP: HOW WEAK INSTITUTIONS IMPACT EXPORT COMPETITIVENESS IN THE EU

ABSTRACT

Institutional quality is a key determinant of national competitiveness, especially in small open economies exposed to international market pressures. Many post-transition economies, including Croatia, are caught in a "Post-Transition Trap" - a situation where weak institutions, despite market reforms, prevent these economies from fully realizing their growth potential and achieving sustained competitiveness. This paper examines how institutional quality, as a non-price competitiveness factor, plays a crucial role in strengthening economic performance. In this study, export performance is used as the main proxy for national competitiveness, enabling a focused empirical assessment of how institutions influence trade outcomes. Traditional models focus on price factors like labor costs, but in a globalized economy, institutional quality becomes increasingly important. Croatia competes in a market where non-EU countries offer lower labor costs. In this context, cost-cutting alone is unsustainable, and higher institutional quality is essential for boosting business confidence, attracting investment, and improving competitiveness.

This study uses panel data analysis with annual data from 2002 to 2023, covering eleven post-transition EU countries (Bulgaria, Czech Republic, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania, Slovakia, and Slovenia). The model includes real exports of goods as a key indicator, grouping variables into price-based and non-price competitiveness factors, with foreign demand as a control variable. The core explanatory variable is institutional quality, measured using World Governance Indicators (WGI), including rule of law, regulatory quality, and political stability.

The relevance of this research is reinforced by the recent Nobel Prize in Economics awarded to Daron Acemoglu, Simon Johnson, and James A. Robinson for their contributions to understanding how institutions shape economic development. Findings indicate that weak institutional quality negatively impacts competitiveness. This study offers policy recommendations to enhance economic performance in post-transition countries, including Croatia.

Key words: *Institutional quality, Competitiveness, Panel data analysis, Post-transition economies.*

1. Introduction

In today's globalised economy, institutional quality has become a key factor in shaping a country's competitive position. Institutions define the rules of the game within which political and economic actors operate. North (1990) describes them as formal and informal rules that structure human interaction and shape resource distribution. They influence incentives, reduce transaction costs, and enable more efficient economic outcomes. Rodrik (2000, 2007)

similarly views institutions as behavioural rules that generate stable expectations among actors. He categorizes them into five groups: property rights, regulatory institutions, macroeconomic stabilization, social security, and conflict management. Participatory political institutions play a central role in maintaining a high-quality institutional framework. Although debates continue over the roots of income disparities, many studies emphasize that strong institutions, particularly those protecting property rights, are crucial for attracting investment, building capital, and raising income levels (Acemoglu et al., 2014).

Institutions refer to formal and informal rules, norms, and organizations, and provide the essential basis for a functioning market system. Beyond law enforcement, they ensure predictability, reduce transaction costs, and foster trust, innovation, and investment. The research of the 2024 Nobel Prize laureates Acemoglu, Johnson, and Robinson confirms that inclusive institutions, those ensuring equal access to opportunities and limiting power abuse, are essential for long-term growth. A functioning legal system, sound regulation, and political stability together create an environment that supports productivity and international competitiveness (Hall and Jones, 1999; Porter, 1990; Pelletier and Bligh, 2006).

The importance of institutional capacity has been further emphasized by recent shifts in the global order. The rise of protectionist policies, trade tensions between the United States and China, and the imposition of tariffs under the administration of Donald Trump signal a new phase of global trade fragmentation. In this context, Europe faces strategic challenges — how to preserve competitiveness while ensuring cohesion among its member states. In a report prepared for the European Commission, Mario Draghi (2025) warns that Europe can no longer rely on the externalities of globalization that have powered its growth for decades. Instead, a redefinition of industrial policy is needed, along with strengthened decision-making and investment implementation capacity, and more effective coordination among EU member states.

It is within this broader institutional context that the concept of the "post-transition trap" emerges, describing a situation in which countries, despite having undergone the initial phases of market liberalization and democratic stabilization, fail to achieve dynamic, sustainable, and competitive growth. Their institutions often exist only formally, while in practice they remain weak, inefficient, or captured by clientelism and political opportunism (Polterovich, 1999, 2004, 2008; North, 1990). Instead of progressing toward models based on high growth and innovation, these countries remain in permanent transition, marked by low productivity, weak institutions, and vulnerability to external shocks. Their growth is usually cyclical and not trend-based, driven by macroeconomic impulses, favorable external conditions or foreign aid, but lacking stable developmental pathways supported by strong, predictable and effective institutions. This post-transition trap represents a structural barrier between nominal progress and real development (Balcerowicz, 2014; Stoyanov, 2019).

This situation is particularly difficult for countries after the transition, which are still grappling with the legacy of weak institutional foundations, limited reform capacity and low productivity. Although they are formally integrated into the European structure, many of these countries have not yet converged with the standards of the most developed EU Member States. Institutional quality is a "invisible obstacle", and its absence often neutralizes the effects of financial assistance, slows down structural adjustment and undermines efforts to diversify exports. In this regard, understanding the relationship between institutional quality and international competitiveness is essential not only for academic discourse, but also for the formulation of sustainable economic policies. *While competitiveness is a multidimensional*

concept, this paper focuses specifically on export performance as its operational measure, reflecting a country's ability to compete in international markets under varying institutional conditions.

The increase in global asymmetries, the increase in technological equivalence, and the institutional fragmentation in the European Union raise serious concerns about the long-term sustainability of growth models in peripheral European economies. True integration and equal participation in the internal market require profound structural transformations, rooted in strengthening the institutional foundations. Consequently, institutions are not merely administrative structures, but strategic resources that shape economies' competitiveness and resilience to global shocks. In the context of an increasingly complex international landscape and growing internal tensions within the EU, the quality of institutions in post-transition countries becomes a critical factor in understanding their developmental prospects — not merely as a statistical indicator, but as the core of their capacity to respond to the challenges of the 21st century. As explained in the introduction, institutions refer to the rules, norms, and organizations that govern political and economic behaviour. In this paper, institutional quality specifically refers to the effectiveness of the rule of law, regulatory quality, and political stability, following the operationalization used in the World Governance Indicators (WGI).
This paper contributes to the existing literature by addressing a gap in empirical research: while the importance of institutions for economic growth is widely recognized, studies examining their impact on export performance, particularly in post-transition and CEE countries, remain limited. Most existing research focuses on price competitiveness or the relationship between institutional quality and GDP, whereas the link between institutional frameworks and trade dynamics is still underexplored. This paper responds to that gap by applying dynamic panel analysis to assess how institutional indicators influence goods exports in post-transition EU economies.

The paper is organized into five sections. Section 2 reviews the literature. Section 3 presents the data and methodology. Section 4 discusses results. Section 5 concludes with policy implications and limitations.

2. Literature review

The relationship between institutions and economic development is well-established in economic theory. Theories by Acemoglu and Robinson (2012), North (1990), and Rodrik (2004) imply that institutions are the primary determinants of sustainable economic growth and competitiveness. Rodrik (2004) points out that institutions outweigh geography and trade in shaping development paths-an observation supported by the superior performance of Central European countries like Slovenia and the Czech Republic over the Western Balkans, despite similar geographic conditions. During the 2022 energy crisis, institutional strength also determined adaptability: Poland responded faster to global shocks than more corrupt peers like Romania. These disparities reflect deeper institutional inequalities, with Western and Northern Europe scoring between 0.8 and 0.9 on institutional quality indices, while Southeastern regions remain at 0.3 to 0.5 (ECB, 2024; UB, 2013). As Acemoglu and Robinson (2012) highlight, only inclusive, well-functioning institutions reduce transaction costs and enable firms to grow and innovate. Without comprehensive reforms, post-transition economies will struggle to converge with Western European standards, regardless of financial support from the EU.

Acemoglu et al. (2001, 2005) state that institutional quality is the key driver of long-term economic outcomes. Inclusive institutions that protect property rights, enforce contracts and encourage participation support innovation, investment and growth. In contrast, extractive institutions hinder these processes and lead to stagnation. Without institutional reform, improvements through capital or technology alone are unlikely to succeed. Thus, strong institutions are essential for productivity and international competitiveness.

Based on these theoretical ideas, many empirical studies have explored specific channels that influence institutional quality in terms of productivity and competitiveness. The institutional framework influences the competitiveness of the country directly not only by shaping macroeconomic stability, but also by improving the microeconomic environment in which enterprises operate. Competitiveness is no longer determined only by labor costs and exchange rates, but increasingly by institutional factors such as governance quality, regulatory efficiency and law enforcement. These institutions are essential in post-transition countries to ensure the confidence of businesses, attract investment, and support structural transformation (Rodrigez-Pose et al. 2020; Merdzan et al. 2024; Trpeski et al. 2024).

Adkins et al. (2002) Agostino et al. (2020) and Égert (2016) have shown that strong institutions significantly improve efficiency and productivity. Adkins et al. In 2002, Agostino et al. stressed the role of property rights, sound monetary policy and free trade. (2020) emphasizes that effective bureaucracy and low corruption are especially beneficial to SMEs. Égert (2016) found that institutional quality increases the ROI of R&D and explains 60% of global factor productivity differences across countries. Together, these studies underline that targeted institutional reforms are essential for closing productivity gaps, particularly in post-transition economies striving to match Western productivity levels.

Productivity, a key channel through which institutions affect competitiveness, remains below the EU average in most post-transition economies. Research shows that productivity in sectors burdened by excessive regulation-such as agriculture and services-lags 15–20% behind EU benchmarks (EIB, 2016; Filip & Setzer, 2025). Regions with poor governance are also more vulnerable to shocks. During the 2022–2023 energy crisis, countries like Hungary and Poland, with weaker institutional resilience, saw sharper drops in industrial output than better-governed economies (Filip et al., 2025).

Alexiou et al. (2020) state that institutional quality has a substantial positive effect on long-term growth in post-socialist economies. Regulatory quality supports short-term growth by reducing bureaucratic burdens. The study confirms that institutional improvements precede economic growth, with stronger outcomes observed in the Baltics compared to weaker-performing regions like the Balkans. The authors emphasize that reforms focused on the rule of law and participatory governance are crucial for sustained development, despite potential short-term instability during transitions.

Among the studies that focus on the origins of institutional quality, particular attention has been given to variables that can be shaped through public policy. In this context, research by Alonso et al. (2020) provides valuable insights into the mechanisms through which states can improve institutional performance. Using panel data, they identify income, tax efficiency, education, redistribution, and openness as key drivers. Efficient taxation fosters accountability, education promotes innovation, and redistributive policies enhance legitimacy. International openness supports convergence with global standards. The study concludes that

institutional quality can be deliberately improved through strategic reforms, reinforcing a positive cycle between institutions and development.

Growing attention has been paid to how institutional quality shapes a country's international competitiveness, not only through macroeconomic stability but also via governance, legal certainty, and innovation capacity. Camargo (2021), based on two decades of literature review, discovered that political stability, regulatory efficiency and corruption control are consistently related to a better global ranking. Effective public administration and transparent legal systems create predictable business environments, lower transaction costs, and support innovation.

Competitiveness is a multidimensional concept with varying definitions and interpretations depending on the level of analysis and methodological approach. It encompasses both microeconomic aspects, such as firm strategy and innovation, and macroeconomic elements, including institutional capacity, productivity, and economic stability. The OECD (Hatzichronoglou, 1996) defines competitiveness as the ability of economic agents to generate high levels of income and employment on a sustainable basis, despite exposure to international competition. Similarly, the World Economic Forum (WEF, 2013) conceptualizes competitiveness through twelve interconnected pillars, including institutions, infrastructure, labour and product markets, innovation, and technological readiness. The European Central Bank (ECB, 2009) further suggests that competitiveness can be operationalized through export growth, market share, and current account balances, particularly in the case of open economies.

Different views exist in the literature regarding the usefulness and applicability of the concept. Krugman (1994) strongly criticizes the use of competitiveness at the national level, arguing that it often obscures the real causes of poor productivity and can lead to politically harmful protectionism. Similarly, Cho and Moon (2000) argue that the analysis of national competitiveness should be grounded in sectoral productivity rather than aggregate macroeconomic indicators. Despite such criticisms, many institutional and empirical approaches retain competitiveness as a valuable analytical framework—especially when clearly defined and appropriately adapted to the specific characteristics of a given economy.
One of the most widely used dimensions of competitiveness in empirical research is export competitiveness. The ECB (2005) defines it as a country's ability to achieve competitive advantages in international markets through price and product quality, while ECB (2014) further includes technological capabilities, institutional conditions, and geographical diversification. Traditional indicators of price competitiveness—such as the real effective exchange rate based on CPI, ULC, or GDP deflator—remain widely used due to their comparability, yet they carry limitations. Marsh and Tokarick (1996) caution that such indicators often ignore trade in intermediate goods, sectoral variations, or cyclical changes in productivity.

In light of these limitations, research increasingly emphasizes non-price competitiveness factors, including product quality, innovation, R&D intensity, institutional performance, and export structure complexity. Monteagudo and Montaruli (2009) define these as residual factors that go beyond price effects and external demand. The ECB (2014) also highlights the importance of intensive and extensive export margins—namely, a country's ability to deepen existing trade relationships and access new markets. Global indices such as the GCI (WEF, 2013) and the WCY (IMD, 2013) offer broader institutional insights, though their application

in empirical analysis faces challenges such as methodological consistency and indicator overlap.

In this paper, export competitiveness is adopted as a concrete, measurable proxy for international competitiveness in post-transition EU countries. This choice is consistent with previous studies that emphasize exports as a key non-price dimension of competitiveness (e.g., Ruzekova, et al., 2018; Bierut and Dybka, 2019), particularly in relation to institutional factors. While export performance does not capture all facets of competitiveness—such as domestic market dynamics or sustainability—it offers a data-driven and internationally comparable basis for assessing how institutional quality shapes external economic performance.

Empirical research increasingly confirms that institutional quality is a key determinant of export performance, particularly through its influence on non-price competitiveness. Ruzekova et al. (2018) show that dimensions such as government effectiveness, regulatory quality, and control of corruption directly shape a country's ability to compete internationally, using exports as a measurable outcome. Building on this, Bierut and Dybka (2019) find that well-functioning institutions not only boost export volumes but also drive structural transformation in the export mix, suggesting a dual role of institutions in enhancing both the scale and complexity of exports. Benkovskis and Wörz (2013) similarly integrate institutional considerations into its composite measure of non-price competitiveness, highlighting how regulatory frameworks and institutional capacity affect export quality and diversification. Further, Xifré, R. (2019) develops an index based on export shares and structural characteristics, once again reinforcing the role of institutions in shaping competitiveness beyond cost-based metrics. Finally, the European Commission (2018) links stronger institutional environments to higher export quality and deeper participation in global value chains. Taken together, these studies illustrate that institutional quality not only facilitates export activity, but fundamentally conditions its long-term structure, sustainability, and global relevance.

To better understand the impact of institutions in the real world, researchers have studied how the quality of institutions influences results in different regions, especially after transition in Europe. Institutional quality plays a central role in the formation of the growth trajectory and competitiveness of EU countries after transition. In the last 20 years, countries in Central and Eastern Europe have undergone major changes, moving from a central planning system to a market-based system. Although great progress has been made, recent literature highlights the persistent institutional weaknesses that continue to hamper long-term convergence with Western European standards.

Vitola and Senfelde (2015) showed that formal and informal institutions affected economic performance, their influence varying depending on the stage of development of a country. Strong institutions improve per capita GDP and life expectancy, and targeted and phase-specific reforms are key to reducing the EU's development gaps. Rodrguez-Pose et al. (2020) highlight that regional institutional quality also shapes productivity at the corporate level. They found that strong institutions not only increased labour productivity, but also reduced the negative impact of credit constraints, especially on SMEs. Together, these studies underscore the importance of institutional adaptation and financial access to reducing regional productivity differences across Europe.

Trpeski et al. (2024) examine how institutional quality affects economic growth in post-transition CEE countries from 2000 to 2020. Their panel regression analysis shows that stronger rule of law and corruption control can raise GDP growth by up to 2.5 percentage points annually, while high corruption reduces public investment efficiency by 30–50%. Countries like Estonia and the Czech Republic outperform weaker institutional peers such as Bulgaria and North Macedonia. The effective use of EU funds also hinges on institutional strength, with transparent countries like Poland gaining more. The authors warn that without major reforms, CEE countries risk long-term stagnation and divergence from Western Europe. Evidence from post-socialist economies confirms that institutional development is central to long-term growth. Countries like Estonia and Poland, with stronger institutions, consistently outperformed peers with weaker governance, achieving 2–3 percentage points higher annual growth (Beck & Laeven, 2005). Historical legacies, such as reliance on natural resources and prolonged socialist rule, often undermined institutional reform by entrenching elite interests. More recent findings reinforce this pattern: Merdzan and Slaveski (2023) show that robust institutions—marked by effective rule of law, corruption control, and regulatory quality—led to faster GDP growth and higher FDI inflows, especially in the Baltics and countries like Poland and Slovakia. In contrast, the Balkans continue to lag due to governance weaknesses. Both studies stress that sustained growth in post-transition economies hinges on anti-corruption efforts, judicial independence, and the strategic use of EU integration to strengthen inclusive governance.

Douarin and Mickiewicz (2022) emphasize that despite progress in regulatory reforms, post-communist countries still face significant shortcomings in overall institutional quality. The authors highlight that persistent issues such as corruption, institutional inefficiency, and social inequality are closely linked to weaker institutional environments and are associated with slower economic growth and lower levels of societal well-being. Their work suggests that the post-communist transition is not yet complete, particularly in areas related to the rule of law and effective governance.

Croatia presents a particularly illustrative case of how institutional challenges can derail the expected gains of transition and EU integration. Kotarski and Petak (2019) examined Croatia's post-communist transition, focusing on how the first advantages (favourable geographical location, developed infrastructure and EU accession) did not translate into sustainable growth. Instead, Croatia fell into a middle-income trap, characterized by stagnation, institutional decline, and persistent clientism. The authors believe that the occupation of the State and the "property economy" (such as political appointments to the public sector) have undermined efforts to improve democracy and reform. Despite membership of the EU, institutional reforms have stalled and only 7 % of EU recommendations have been implemented by 2019. The deindustrialization of Croatia, excessive regulation and the elite's search for rents have discouraged foreign investment and innovation. In comparison with other Central European countries, Croatia's GDP growth lags between 1990 and 2019, falling by 15 to 20 percentage points. The fragmented coalitions, short-term political calculations and weak reform impulse have further reinforced these problems. The authors concluded that dismantling clientele and strengthening institutions were essential to escaping the trap of middle-income and enhancing long-term competitiveness.

Rogić Dumančić et al. (2021) examine the link between the quality of the European Union institution and the effectiveness of the product market (PME), with a focus on Croatia. This paper provides empirical evidence that institutional weaknesses and corruption significantly affect market performance. A stronger institution, with transparency, constitutional rule and

regulation quality, promotes competition and reduces transaction costs, while corruption distorts market mechanisms and reduces efficiency. Croatia is lagging behind EU due to persistent institutional shortcomings such as bureaucratic inefficiency, political instability and high levels of corruption. These deficiencies reflect lower PME scores than in countries such as Slovenia. These conclusions highlight the need for institutional reform to improve competitiveness and bridge the gap between older and younger EU Member States.

Beyond individual countries, wider research at EU level highlights the importance of a robust institutional framework to improve competitiveness and resilience across Member States. Filip and Seizer (2025) studied how regional institutional quality affected EU economic growth and resilience using data from about 200 regions between 2010 and 2021. They found that regions with stronger institutions, characterized by transparent governance, effective public administration and corruption control, grew on average 0.5 percentage points per year, and that those with the poorest regions converged to the EU average and increased their growth by 0.8 percentage points per year. Strong institutions also enhance resilience: such regions are three times less likely to experience severe crises, while weaker ones suffered an additional 4-percentage-point GDP decline during the COVID-19 pandemic. Notably, intra-country disparities often exceed inter-country gaps, emphasizing the need for regional-level reforms.

These conclusions show that strong regional institutions not only support growth and resilience, but also support broader competitiveness. Filip et al. expanded this view. (2025) argue that weak institutions contribute to the European delay in productivity, innovation and digital transformation of the United States and China. More than half of the EU countries have experienced a decline in governance indicators, while administrative delays, such as the slow use of FRF funds, have further hampered performance. The authors call for regulatory simplification, stronger public administration and investment in digital and green skills, warning that without effective institutions and coordinated reforms, Europe risks long-term stagnation and competitive decline.

Although the report of the European Investment Bank (2016) is a bit older, it remains relevant to understand the structural weaknesses persisting in EU competitiveness, such as declining productivity, underinvestment and fragmented financial markets, which continue to shape European competitiveness today. It emphasizes that the restoration of competitiveness requires the strengthening of innovation, skills, infrastructure and, above all, institutional quality, defined as effective regulation, security of property rights and market efficiency. Initiatives such as the Europe Investment Plan and the European Strategic Investment Fund (EFSI) are examples of this approach. The EIB's 2025 report firmly reaffirms these priorities and emphasizes that effective institutions are crucial to boosting competitiveness, attracting investment and addressing the growing global and internal challenges of the EU.

To conclude, institutional quality remains a decisive factor in determining the productivity and competitiveness of the EU economy after transition. While historical legacy continues to be a challenge, countries that have undertaken timely and effective institutional reforms show more dynamic and resilient growth patterns. Strengthening the quality of institutions, through transparent governance, efficient administration and the rule of law, remains the basis for sustainable convergence and long-term economic resilience within the European Union.

Based on the theoretical foundations and reviewed empirical literature, this paper formulates the following research questions: how does institutional quality influence export

competitiveness in post-transition EU countries, and are these effects asymmetric depending on whether a country's institutional performance falls below or exceeds the expected EU benchmark? From these questions, the following hypotheses are derived:

H1: Institutional quality positively affects export performance.

H2: The positive effect of institutional quality on exports is stronger in countries with an institutional deficit (*inst_low*) than in those with an institutional surplus (*inst_high*).

3. Data and Methodology

This paper examines the role of institutional quality as a non-price factor of competitiveness in the export function of post-transition EU economies. To assess the impact of institutional quality on export performance, a panel regression analysis is applied.

The analysis uses annual data covering the period from 2002 to 2023 (depending on the data availability). The sample includes eleven post-transition EU member states: Bulgaria, Czech Republic, Estonia, Croatia, Latvia, Lithuania, Hungary, Poland, Romania, Slovakia, and Slovenia. The dependent variable is real exports of goods, which serves as a proxy for export competitiveness. Data description and sources are available in Table 1.

Explanatory variables are grouped into price and non-price competitiveness factors, with special emphasis on institutional quality as the core non-price variable in this paper. Also, exports depend not only on price and non-price competitiveness factors, but also on the business cycles of the countries' main trading partners. Therefore, to account for external demand conditions, foreign demand is included in the model as a control variable.

Table 1: Data description and sources

	Variable	Label	Time	Measure	Source	The expected theoretical sign
Dependent variable	Exports of goods	EXPORTS	2002-2023	Chain linked volumes, index 2010=100	Eurostat	
Price competitiveness factors	Real effective exchange rate (deflator: consumer price index - 27 trading partners - European Union from 2020)	REER	2002-2023	Index, 2015=100	Eurostat	-
Non-price competitiveness factors	Institutional quality – composite index	INST	2002-2023	Rating, value scale from -2.5 to 2.5.	Author's calculation; World Bank WGI (World Governance Indicators).	+

	Variable	Label	Time	Measure	Source	The expected theoretical sign
	Institutional gap – below expectation	inst_low	2002-2023	Interaction term (INST × dummy for inst_gap < –0.5)	Author's calculation; World Bank WGI (World Governance Indicators).	+
	Institutional gap – above expectation	inst_high	2002-2023	Rating, value scale from -2.5 to 2.5.	Author's calculation; World Bank WGI (World Governance Indicators).	+/–/0
	Labour productivity	PROD	2002-2023	Real labour productivity per hour worked, index 2015=100	Eurostat	+
Control variables	Gross domestic product at market prices, EA12	GDPEU	2002-2023	Chain linked volumes, index 2010=100	Eurostat	+

Source: Author

In order to assess the impact of price competitiveness, the model includes the real effective exchange rate (REER). The REER is defined such that an increase in the index indicates a real appreciation of the national currency. The expected sign is negative, as a real depreciation (a decline in the index) tends to stimulate exports by improving price competitiveness. The deflator used is the consumer price index, based on 27 trading partners, with the European Union reference from 2020 (Eurostat).

The second group of explanatory variables thus captures non-price competitiveness factors through institutional dimensions. Institutional quality is measured using a composite index based on three World Governance Indicators (WGI): rule of law (RL), regulatory quality (RQ), and political stability (PS). These indicators are obtained from the World Bank's WGI database and are measured on a standardized scale ranging from –2.5 to +2.5. A strong rule of law contributes to a stable business environment and reduces transaction costs, thereby positively affecting export competitiveness. Higher regulatory quality enhances efficiency, fosters entrepreneurship, and facilitates investment - key elements of non-price competitiveness. A politically stable environment enhances predictability, builds investor confidence, and facilitates international trade flows. To obtain a more concise and analytically tractable measure of institutional performance, the model employs an aggregate index (INST), calculated as the arithmetic mean of RL, RQ, and PS. This approach preserves the conceptual breadth of the individual indicators while reducing multicollinearity and simplifying interpretation within the empirical framework.

All three components of the institutional index are expected to positively affect export performance, as stronger institutions reduce uncertainty and enhance competitiveness through better governance. Accordingly, the aggregated variable INST is theoretically expected to exhibit a positive coefficient in export competitiveness models, as it reflects a country's overall institutional capacity to support a stable, predictable, and efficient market environment.

The variables inst_low and inst_high are based on the institutional gap (inst_gap). It measures the difference between a country's actual level of institutional quality and the level that would be expected given the economic development of the euro area. This approach allows for an analysis of institutional quality not in absolute terms, but relative to a country's positioning vis-à-vis its main export market. In the broader context of European integration, this concept reflects the structural division within the EU - between the "core" and the "periphery," or between older EMU member states and newer post-transitional economies. The European Commission (2017) has already highlighted the idea of a "multi-speed Europe". In other words, there are different levels of readiness and capacity among member states for deeper integration. Within this framework, inst_gap serves as an indicative measure of "integration distance," illustrating the extent to which a country's institutional practice deviates from the standards prevailing in more developed parts of the EU. The variable inst_low captures an institutional deficit relative to the expected EU benchmark, while inst_high may reflect an institutional surplus, the economic implications of which are not always straightforward.

In order to capture the potential heterogeneity in the effect of institutional quality on export performance, the model introduces interaction variables that distinguish between countries whose institutional performance is below or above what would be expected given their level of development. Specifically, the institutional gap (inst_gap) is calculated as the residual from a regression of the composite institutional index (INST) on the gross domestic product of the euro area (GDPEU), which serves as a benchmark reflecting the institutional standards of the primary export market. Based on this gap, two interaction variables are constructed: inst_low (INST × dummy for inst_gap < –0.5) and inst_high (INST × dummy for inst_gap > 0.5).

The variable inst_low captures cases where institutional quality is significantly below what would be expected relative to the euro area benchmark. In such contexts, even marginal improvements in institutional capacity may have a strong positive effect on export competitiveness, as they reflect catching-up dynamics. Therefore, a positive sign is expected for inst_low. On the other hand, inst_high reflects situations where a country's institutional quality exceeds the level expected for its stage of economic development. The effect of this "institutional surplus" is theoretically ambiguous: while it may support higher-quality governance and long-term investment, it may also generate inefficiencies, overregulation, or mismatches with the productive structure, particularly in less developed economies. Accordingly, no clear theoretical sign is expected for inst_high, although it is reasonable to assume that its effect will be smaller and potentially weaker in magnitude (compared to inst_low), or even negative.

Productivity is incorporated into the model as a structural, non-price determinant of competitiveness, given its role in enhancing export performance through improved efficiency, technological advancement, and the capacity to generate higher value-added outputs independently of price changes. Economies with higher productivity levels are better positioned to compete on the basis of product quality, innovation, reliability, and delivery capabilities, rather than relying solely on cost reductions. Non-price competitiveness is

typically categorized into structural factors (including productivity, innovation, and human capital) and institutional factors (such as the rule of law, regulatory quality, and political stability). Within this conceptual framework, the variable PROD captures the ability of exporting sectors to differentiate themselves through value and complexity. Accordingly, a positive relationship between productivity and export performance is theoretically expected.
Additionally, to account for external demand conditions, the model includes a control variable: the gross domestic product at market prices for the euro area (EA12), labeled GDPEU. This variable is expressed as a chain-linked volume index (2010=100) and reflects foreign demand for exports from the countries in the sample. A positive relationship with exports is expected, as stronger economic activity in partner countries increases demand for imported goods.

The standard export function typically includes foreign demand and the real exchange rate as key determinants. However, in the context of increasingly globalized and competitive markets, non-price factors - particularly institutional quality - play an essential role in shaping export performance.

To account for the dynamic nature of export behavior and potential endogeneity of the regressors, the empirical analysis employs a dynamic panel model estimated using the system Generalized Method of Moments (system GMM) developed by Blundell and Bond (1998). This method is suitable for datasets with a relatively small number of cross-sectional units and a larger time dimension and addresses endogeneity by using lagged values of the dependent and explanatory variables as instruments. In economic modelling, it is well established that current values of a variable are often directly influenced by their own past values. Therefore, the model includes a lagged dependent variable (exports) to capture the dynamic component of export performance. The subsequent statistical significance of this lagged variable further confirms the appropriateness of the dynamic panel approach.

In addition to the main explanatory variables, the model incorporates the institutional gap variable (inst_gap), defined as the residual from a linear regression of the composite institutional index (INST) on the euro area GDP (GDPEU). This residual reflects the deviation of each country's institutional quality from the level expected based on the institutional standards of its primary export market. Based on this gap, two interaction variables are defined: inst_low, which equals INST when inst_gap < –0.5 (indicating a significant institutional shortfall), and inst_high, which equals INST when inst_gap > 0.5 (indicating a potential institutional surplus). The thresholds of ±0.5 were selected as they represent a meaningful deviation from the benchmark while ensuring a sufficient number of observations in both groups. This classification enables the testing of asymmetric effects of institutional quality on export performance, depending on whether a country is below or above the expected institutional standard.
Using the panel dataset described above, covering eleven post-transition EU economies over the period 2002–2023, the following dynamic panel model is estimated:

$$(1)\ EXPORTS_{it} = \beta_0 + \beta_1 * EXPORTS_{i,t-1} + \beta_2 * GDPEU_{it} + \beta_2 * REER_{it} + \beta_3 * RL_{it} + \beta_4 * PROD_{it} + \beta_5 * inst_low_{it} + \beta_5 * inst_high_{it} + \varepsilon_{it}$$

where i denotes country and t denotes year. The inclusion of the lagged dependent variable EXPORTS_i,t-1 captures export persistence and justifies the use of dynamic panel techniques. Robust standard errors are applied to correct for heteroskedasticity and autocorrelation in the

residuals, while instrument validity is assessed using the Hansen test for overidentifying restrictions and the Arellano-Bond tests for serial correlation.

4. Results and Discussion

This section presents and interprets the empirical results obtained from the model described in the previous part of the paper. The analysis focuses on the impact of institutional quality, with particular emphasis on the asymmetric effects arising from the institutional gap. The interpretation is structured to assess the statistical significance, direction, and magnitude of the estimated coefficients, with special attention given to the interaction variables inst_low and inst_high.

These variables allow for the examination of whether the effect of institutional quality on exports differs depending on whether a country falls below or above the expected institutional standard. All results are interpreted in line with the theoretical assumptions outlined earlier and are assessed in terms of their economic relevance and statistical robustness. The results are presented in Table 2.

Table 2: Dynamic panel regression results (System GMM)

VARIABLES	System GMM Results
L.EXPORTS	0.514***
	(0.053)
inst_low	39.326***
	(8.587)
inst_high	5.539*
	(3.153)
PROD	0.853***
	(0.128)
GDPEU	1.383***
	(0.262)
REER	-0.266***
	(0.095)
Constant	-137.240***
	(26.329)
Observations	231
Number of ID	11
AR(1) p-val	0.00900
AR(2) p-val	0.113
Hansen p-val	0.996

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author

The estimated model demonstrates a high degree of methodological robustness and statistical stability. The Hansen test confirms the validity of the instruments (p = 0.986), indicating that the chosen instruments are neither overfitted nor endogenous. The Arellano-Bond tests for serial correlation are also consistent with expectations for dynamic panel models: the test for first-order correlation (AR(1)) shows statistically significant autocorrelation in the differenced residuals, which is expected due to the inclusion of a lagged dependent variable. Crucially, the second-order correlation test (AR(2)) is not statistically significant, confirming the absence of

higher-order serial correlation and thereby supporting the correct specification of the model. In addition, the significance of the lagged dependent variable supports the need for a dynamic export function specification.

All main coefficients display the expected signs and are statistically significant. Estimated coefficients for Euro area GDP (control variable) and the real effective exchange rate, confirm the basic logic of the export function: depreciation of the national currency increases price competitiveness, while growth in external demand generates a positive impulse for exports. The effect of productivity is strong and statistically significant, further confirming the importance of structural, non-price factors in building export competitiveness.

Special attention in the analysis is given to the results related to institutional variables. The statistically significant and large coefficient for the variable inst_low indicates that countries with below-benchmark institutional quality have the most to gain from reform efforts. In other words, improvements in the rule of law, regulatory quality, and political stability in institutionally weaker countries generate higher marginal benefits for export performance. This can be interpreted through the logic of an institutional "catching-up" process. Such dynamics are particularly relevant for countries undergoing a transitional phase of institutional consolidation while simultaneously striving to strengthen their international competitiveness. In this context, even partial reforms can have a strong signalling effect, increase market confidence, and reduce risks associated with transaction costs and regulatory uncertainty.

On the other hand, the variable inst_high, which captures the effect of institutions in countries exceeding the expected institutional benchmark, also shows a positive and statistically significant effect, but with considerably lower magnitude. This result suggests a possible non-linear relationship in the impact of institutional quality - when institutions surpass the level deemed appropriate for a country’s stage of development, the additional contributions to competitiveness may become limited. In such cases, the effects are likely to shift from immediate gains to more indirect channels, such as improved investment conditions, a stronger legal framework, or long-term business environment stability. However, in the absence of adequate structural alignment, a high level of institutional development may even lead to mismatch with the productive base or generate regulatory burden, thus reducing its direct impact on export efficiency.

In this paper, the terms *inst_low* and *inst_high* are derived from a threshold regression model that differentiates countries based on whether their institutional quality is below or above the EU average benchmark. The concept of “institutional surplus” refers to cases where institutional quality exceeds this benchmark—not in an absolute sense, but relative to the country's stage of development. In such contexts, high institutional quality may yield diminishing returns if not aligned with the country's productive structure, innovation capacity, or export base. Without complementary reforms, excessive regulatory complexity or institutional rigidity may even constrain competitiveness rather than enhance it.

Ultimately, the results confirm that institutional quality does not operate uniformly across contexts - its effect depends on a country’s relative position with respect to the integration benchmark. While countries with an institutional deficit experience the highest returns from reform, those already above the expected standard tend to observe more modest effects, implying that reform priorities should be aligned with the country’s stage of institutional development.

These findings are in line with prior literature that highlights the differentiated effects of institutional quality depending on the level of development. Bierut and Dybka (2019) emphasize that institutional development not only directly improves export performance but also transforms export structure, with particularly strong effects in countries with weaker institutions. Similarly, Ruzekova et al. (2018) show that reforms in governance and regulatory quality generate more significant export gains in countries with lower baseline institutional capacity. These results also correspond to the ECB's (2014) findings that non-price competitiveness, shaped by institutional features, plays a key role in export dynamics, especially for emerging economies. The asymmetric impact observed in this paper thus reflects both empirical regularities and theoretical expectations.

5. Conclusion

This paper examined the role of institutional quality as a non-price factor of competitiveness in export performance among post-transition EU countries. Based on the assumption that institutions affect export performance indirectly — through regulatory effectiveness, trust in the judiciary, and political stability — the analysis incorporated a composite index of institutional quality, along with interaction variables that differentiate the effects depending on the level of institutional development. The model was estimated using dynamic panel analysis (system GMM) on a sample of eleven countries for the period 2002–2023.

The results show that institutional quality has a positive effect on exports, but this effect varies depending on a country's initial level of institutional development. Countries that remain trapped in a post-transition trajectory, marked by persistently weak institutions, benefit most from institutional improvements. The greatest gains are recorded in countries lagging behind the expected institutional standards, while the effect is more moderate — though still positive — in countries that already exceed the benchmark. This finding highlights the structural nature of post-transition traps in which weak institutions, despite formal EU integration, limit competitiveness. It also confirms the importance of institutional "recovery" effects and the need for a differentiated policy approach when defining reform priorities.

In addition to its policy relevance, the paper contributes to the existing literature by empirically confirming the asymmetric effects of institutional quality on export performance in post-transition EU countries. It extends prior research by integrating the concept of the institutional gap and demonstrating how institutional improvements generate varying outcomes depending on a country's position relative to EU benchmarks. The results have a clear impact on economic policy makers. In countries with a higher institutional deficit, reform efforts aimed at improving the rule of law, regulatory quality and political stability could have a significant impact on export performance. In these contexts, addressing the weaknesses of institutional foundations is not only a problem of governance, but a strategic prerequisite for escaping the trap of post-transition. In the most advanced countries, which already exceed the expected institutional standards, additional reform measures must be carefully aligned with the economic structure in order to avoid excessive regulation and inefficiency. In all cases, institutional reform should not be approached in isolation, but rather as part of a broader strategy for strengthening competitiveness, investment, and export orientation.

While the results reveal consistent patterns, the analysis is based on aggregate country-level data, which limits the ability to capture sector-specific effects or identify detailed

mechanisms. Additionally, certain methodological limitations arise from the nature of the available data — the dataset is based on annual observations and covers a relatively short time period, which may reduce the power of some statistical tests that rely on asymptotic properties. Moreover, the use of exports as a proxy for competitiveness, though widely used, has certain conceptual limitations. It does not capture domestic market dynamics, is sensitive to external shocks, and may not reflect value-added creation, innovation capacity, or sectoral differences.

Future research could overcome these constraints by incorporating sector-level or firm-level data and by applying broader competitiveness indicators that account for sustainability, structural transformation, and productivity beyond export outcomes. Furthermore, future research could extend the analysis to a sectoral level to examine whether institutions exert a uniform effect across different export industries. A comparative analysis with developed countries could further illuminate the role of institutional surplus under conditions of institutional maturity. More broadly, future work should explore how post-transition economies can move beyond institutional stagnation and chart a path toward resilient, innovation-driven competitiveness.

REFERENCES

Acemoglu, D., Gallego, F. & Robinson, J. A. (2014): ***Institutions, Human Capital and Development***, Annual Review of Economics, Vol 6, https://doi.org/10.1146/ annurev-economics-080213-041119.

Acemoglu, D., & Robinson, J. (2012): ***Why Nations Fail: The Origins of Power, Prosperity and Poverty***, Crown Publishing Group.

Acemoğlu, D., Johnson, S., & Robinson, J. (2001): ***The Colonial Origins of Comparative Development: An Empirical Investigation***, American Economic Review, Vol. 91, No. 5, pp. 1369–1401. https://doi.org/10.1257/aer.91.5.1369

Acemoğlu, D., Johnson, S., & Robinson, J. (2005): ***Institutions as a Fundamental Cause of Long-Run Growth***, in: Aghion, P., Durlauf, S. N., eds.: Handbook of Economic Growth, Volume 1, Part A, North-Holland, Amsterdam, pp. 384–473. https://doi.org/10.1016/s1574-0684(05)01006-3

Adkins, L. C., Moomaw, R. L., & Savvides, A. (2002): ***Institutions, Freedom, and Technical Efficiency***, Southern Economic Journal, pp. 92–108. https://doi.org/10.2307/1061558

Agostino, M., Di Tommaso, M. R., Nifo, A., Rubini, L., & Trivieri, F. (2020): ***Institutional Quality and Firms' Productivity in European Regions***, Regional Studies, Vol. 54, No. 9, pp. 1275–1288. https://doi.org/10.1080/00343404.2020.1712689

Alexiou, C., Vogiazas, S., & Solovev, N. (2020): ***Economic growth and quality of institutions in 27 postsocialist economies***. Journal of Economic Studies, 47(4), 769-787.

Alonso, J. A., Garcimartin, C., & Kvedaras, V. (2020): ***Determinants of institutional quality: an empirical exploration***. Journal of Economic Policy Reform, 23(2), 229-247

Beck, T., & Laeven, L. (2005): ***Institution Building and Growth in Transition Economies***, World Bank Policy Research Working Paper, No. 3657, July 2005.

Benkovskis, K., & Wörz, J. (2013). ***Non-price competitiveness of exports from emerging countries.*** ECB Working Paper Series No. 1612, European Central Bank.

Blundell, R., & Bond, S. (1998): ***Initial conditions and moment restrictions in dynamic panel data models***. Journal of Econometrics, 87(1), 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8

Camargo, M. I. B. (2021): ***Institutions, institutional quality, and international competitiveness: Review and examination of future research directions***. Journal of Business Research, 128, 423-435.

Cho, D. S., Moon, H. C. (2000): ***From Adam Smith to Michael Porter: Evolution of Competitiveness Theory***. Singapore: World Scientific Publishing.

Draghi, M. (2025): ***Competitiveness, Productivity and EU Coordination: A Policy Framework for the Next Decade***. European Commission. https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en#paragraph_47059

Douarin, E., & Mickiewicz, T. (2022): ***Is the post-communist transition over?***. IZA World of Labor, Article No. 494. https://doi.org/10.15185/izawol.494

Égert, B. (2016): ***Regulation, Institutions, and Productivity: New Macroeconomic Evidence from OECD Countries***, American Economic Review, Vol. 106, No. 5, pp. 109–113. https://doi.org/10.1257/aer.p20161026

ECB – European Central Bank (2024): ***Institutional Preconditions for Absorbing EU Funds in Eastern Europe***, ECB Working Paper Series, No. 3014. https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp3014~757446ef99.en.pdf

ECB - European Central Bank (2014): ***Competitiveness Research Network Interim Report II: Results in 2013 and plans for 2014***. CompNet – The Competitiveness Research Network.

ECB - European Central Bank (2009): Jean-Claude Trichet: ***The external and internal dimensions of Europe's competitiveness.*** Speech at the Institute of International and European Affairs, Dublin, 26 February.

ECB - European Central Bank (2005): ***Competitiveness and the Export Performance of the Euro Area***. ECB Occasional Paper No. 30.

European Commission (2018): ***The determinants of export quality in the euro area.*** Quarterly Report on the Euro Area, 17(1), 23–31.

European Commission. (2017): ***White Paper on the Future of Europe: Reflections and scenarios for the EU27 by 2025*** (COM(2017)2025). Brussels: European Commission. https://commission.europa.eu/document/download/b2e60d06-37c6-4943-820f-d82ec197d966_en?filename=white_paper_on_the_future_of_europe_en.pdf

European Investment Bank (2016): ***Restoring EU Competitiveness – 2016 Updated Version***, Luxembourg: EIB. https://www.eib.org/attachments/efs/restoring_eu_competitiveness_en.pdf

European Investment Bank (2025): ***Investment Report 2024/2025: Innovation, Integration and Simplification in Europe.*** , Luxembourg: EIB. https://www.eib.org/attachments/lucalli/20240354_investment_report_2024_en.pdf

Eurostat (various years): ***Database***. http://ec.europa.eu/eurostat/data/database. (Accessed 5 February, 2025).

Filip, M.-D., & Setzer, R. (2025): ***The Impact of Regional Institutional Quality on Economic Growth and Resilience in the EU***, ECB Working Paper Series, No. 3045, Frankfurt am Main: European Central Bank. https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp3045~ad74f198a7.en.pdf

Filip, M.-D., Momferatou, D., & Parraga Rodriguez, S. (2025): ***European Competitiveness: The Role of Institutions and the Case for Structural Reforms***, ECB Economic Bulletin, Issue 1 / 2025, pp. 79–94. https://www.ecb.europa.eu/pub/pdf/ecbu/eb202501.en.pdf

Hall, R. E., & Jones, C. I. (1999): ***Why do some countries produce so much more output per worker than others?***. Working Paper, Cambridge, MA: National Bureau of Economic Research, http://www.nber.org/papers/w6564

Hatzichronoglou, T. (1996): ***Globalization and Competitiveness: Relevant Indicators***, OECD Science, Technology and Industry Working Papers, No. 1996/05, OECD Publishing.

IMD (2013): ***World Competitiveness Yearbook***. Lausanne: International Institute for Management Development.

Kotarski, K., & Petak, Z. (2019): ***Croatia's Post-communist Transition Experience: The Paradox of Initial Advantage Turning into a Middle-Income Trap***, in: Petak, Z., Kotarski, K., eds.: Policy Making at the European Periphery, Palgrave Macmillan, pp. 1–25.

Krugman, P. (1994**): *Competitiveness: A Dangerous Obsession***, *Foreign Affairs*, 73(2), 28–44.

Marsh, I. W., Tokarick, S. P. (1996): ***An assessment of three measures of competitiveness***. *Weltwirtschaftliches Archiv*, 132(4), 700–722.

Merdzan, G., & Slaveski, T. (2023): ***A Comparative Study of Institutional Quality and Economic Performance of Selected Post-Transition Countries from Central and Eastern Europe***, in: International Congress on Eurasian Economies 2023, Proceedings, pp. 374–381.

Merdzan, G., & Slaveski, T. (2024): ***Institutions and Economic Growth in Post-Transition Countries,*** **Journal of Eurasian Economies**, Vol. 3, No. 1, pp. 17–31.

Monteagudo, J., Montaruli, F. (2009): ***Analysing Non-Price Competitiveness in Euro Area Countries***. European Commission Economic Papers, No. 398.

North, D. C. (1990): ***Institutions, Institutional Change and Economic Performance***, Cambridge University Press.

OECD – Organisation for Economic Co-operation and Development (1998): ***Sustainable Institutions for European Union Membership***, OECD Publishing. https://www.oecd.org/content/dam/oecd/en/publications/reports/1998/01/sustainable-institutions-for-european-union-membership_g17a1de2/5kml611h8s30-en.pdf

Pelletier, K. L., & Bligh, M. C. (2006): ***Rebounding from corruption: perceptions of ethics program effectiveness in a public sector organization***. Journal of Business Ethics, 67(4), 359–374. doi: 10.1007/s10551-006-9027-3.

Polterovich, V.M. (1999): ***Institutional traps and economic reforms***, Ekonomika i matematicheskiye metody, Volume 35 (2), pp. 1-37.

Polterovich, V.M. (2004): ***Institutional traps: is there a way out?*** Obshchestvennyye nauki i sovremennost, Issue 3, pp. 5–16.

Polterovich V. (2008): ***Institutional Trap***, In: Palgrave Macmillan (eds) The New Palgrave Dictionary of Economics. Palgrave Macmillan, London. https://doi.org/10.1057/978-1-349-95121-5_2717-1

Porter, M. E. (1990): ***The competitive advantage of nations***, New York, NY: The Free Press.

Rodríguez-Pose, A., Ganau, R., Maslauskaite, K., & Brezzi, M. (2020): ***Credit Constraints, Labor Productivity, and the Role of Regional Institutions: Evidence from Manufacturing Firms in Europe***, Journal of Regional Science, pp. 1–30. https://doi.org/10.1111/jors.12514

Rodrik, D. (2007): ***One Economics, Many Recipes: Globalization, Institutions, and Economic Growth***, Princeton: Princeton University Press, https://doi.org/10.2307/j.ctvcm4jbh.

Rodrik, D. (2004): ***Institutions Rule: The Primacy of Institutions over Geography and Integration***, Harvard University. https://drodrik.scholar.harvard.edu/files/dani-rodrik/files/institutions-rule.pdf

Rodrik, D. (2000): ***Institutions for High-Quality Growth: What They Are and How to Acquire Them***, Studies in Comparative International Development, Vol. 35, pp. 3–31, https://doi.org/10.1007/BF02699764.

Rogić Dumančić, L., Bogdan, Ž. & Raguž Krištić, I. (2021): ***Institutions and Product Market Efficiency in the European Union with Emphasis on Croatia***. In 10th International Scientific Symposium Region, Entrepreneurship, Development (RED 2021) (pp. 997-1010).

Ruzekova, V., Kittova, Z., & Steinhauser, D. (2020): ***Export Performance as a Measurement of Competitiveness***. Journal of Competitiveness, 12(1), 145–160. https://doi.org/10.7441/joc.2020.01.09

Trpeski, P., Merdzan, G., & Kozeski, K. (2024): ***Institutions and Economic Growth***, Zbornik radova Ekonomskog fakulteta u Rijeci, Vol. 42, No. 2, pp. 447–478.

University of Barcelona (2013): ***Institutional Divergence and EU Convergence: Lessons from Southern Europe***, SEARCH Project, WP 5.11. http://www.ub.edu/searchproject/wp-content/uploads/2013/01/WP-5.11.pdf

Vitola, A., & Senfelde, M. (2015): ***The role of institutions in economic performance***, Business: Theory and Practice, Vol. 16, No. 3, pp. 271–279. https://doi.org/10.3846/btp.2015.498

World Economic Forum (2013): ***The Global Competitiveness Report 2013–2014***. Geneva: World Economic Forum.

Worldwide Governance Indicators, 2024 Update, World Bank (www.govindicators.org), Accessed on 10/03/2025.

Xifré, R. (2019): ***Overlooked in the Debate? Non-price Competitiveness in the Five Largest Euro Area Countries***. IESE Business School, Working Paper No. 1235-E, September 2019.

A scientific paper

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SUSTAINABLE CONSUMPTION AMONG UNIVERSITY STUDENTS: KNOWLEDGE, ATTITUDES AND BARRIERS

ABSTRACT

This study explores university students' knowledge, attitudes, and behaviors related to sustainable consumption, with a focus on information sources, trust in corporate claims, and perceived barriers. The research was conducted among 193 students at the University of Osijek, Croatia. Findings show that students are generally familiar with popular sustainability terms such as "zero waste" and "bioplastics," but have limited knowledge of more technical concepts and eco-certifications. Although the majority of students express pro-sustainability attitudes and a sense of consumer responsibility, these values are not consistently reflected in their purchasing behavior. Key barriers include high product prices, limited availability of sustainable products, and a lack of trust in corporate sustainability claims. Correlation analyses revealed strong interconnections between knowledge, attitudes, trust, and sustainable behaviors. Specifically, the ability to recognize credible labels and trust in corporate information were positively associated with sustainable actions. Female students demonstrated stronger sustainability-related attitudes and behaviors compared to their male peers. The majority of students expressed a strong desire for more sustainability education within academic settings. The study highlights the need for the integration of sustainability education into higher education curricula to empower students as informed and critical consumers.

Key words: *University students,* S*ustainability, Purchasing behavior, Sustainability education, Greenwashing.*

1. Introduction

Today's world is grappling with a variety of environmental challenges, including climate change, air pollution, and biodiversity loss. These problems, among others, are addressed by the United Nations through its 17 Sustainable Development Goals (United Nations, n.d.), which call for collective action from governments, businesses, and individuals. Consumers play a vital

role in sustainable development, as their everyday purchasing choices can influence environmental transformations. Therefore, it is crucial that individuals recognize the impact of their consumption habits and actively participate in fostering more sustainable consumption behaviors (Nakaishi & Chapman, 2024). The increasing global awareness of sustainability issues has made eco-labeled products and green consumerism more prominent and visible (Nakaishi & Chapman, 2024). However, consumer knowledge regarding sustainability and sustainable practices is inconsistent, often accompanied by skepticism towards environmental claims made by companies (Rambandara & Dilanthi, 2024; Heo & Muralidharan, 2017). Although young people are frequently perceived as environmentally conscious and socially responsible, numerous studies reveal a significant discrepancy between pro-environmental attitudes and actual purchasing behavior (Sonnenberg et al., 2014, 345). Sustainable consumption is influenced by both internal and external factors. Internal motivations arise from personal values, environmental awareness, and a sense of moral duty. Research has shown that altruistic and biospheric values significantly encourage behaviors such as adopting plant-based diets and minimizing food waste. External drivers, on the other hand, include social norms, financial incentives, and regulatory policies. Social influences particularly shape the decisions of younger consumers (Nichifor, Zait & Timiras, 2025). Within this context, university students are considered a particularly relevant demographic group due to their potential to influence future consumer trends and policy decisions. This study aims to assess university students' knowledge of sustainability-related concepts, their attitudes toward sustainable products and practices, sources of information they rely on, and perceived barriers in adopting sustainable purchasing behavior. The study is based on existing theoretical frameworks that explain the multidimensional nature of green purchase intention (Rambandara & Dilanthi, 2024) and seeks to examine these relationships in a local context.

2. Literature Review

A literature search was conducted via several scientific databases focusing on topics related to sustainability, university students, and consumer behavior. A significant increase in research studies since 2020 indicates growing academic and societal interest in the topic, reflecting global environmental challenges and increased consumer awareness. Several factors that influence sustainable consumption behavior among students have been identified, such as environmental attitudes, social influence, personal experience, environmental knowledge, etc. (Rambandara & Dilanthi, 2024). Research studies emphasize that while students generally possess basic knowledge of sustainability concepts, for example, carbon footprint, circular economy, and eco-labels, their understanding is often fragmented and limited (Rambandara & Dilanthi, 2024, 81; Sonnenberg et al., 2014, 340). Furthermore, although students generally express positive environmental attitudes, they do not consistently translate into sustainable consumer behavior (Tran et al., 2022, 6; Kakalia, 2022, 10). Multiple studies highlight the intention - behavior gap, meaning that students express a willingness to act sustainably but encounter obstacles that prevent them from doing so (Sonnenberg et al., 2014, 345; Heo & Muralidharan, 2017, 8). These barriers include high prices, lack of availability, limited access to reliable information, and skepticism toward corporate sustainability claims (Chen et al., 2020, 5; Szaban et al., 2021, 212). The perception of product attributes, including price, quality, availability, and labeling, plays a crucial role in green purchasing decisions. Students are more likely to choose eco-friendly products if they perceive them as affordable, trustworthy, and clearly certified (Rambandara & Dilanthi, 2024, 79; George & Silva, 2022, 596). However, even when students recognize green labels or claims, they may not trust them, especially if they perceive them as vague or exaggerated (Watchravesringkan et al., 2023, 13). Students tend to

prioritize convenience and affordability, which often puts sustainable alternatives at a disadvantage (Kakalia, 2022, 14). Research indicates that social influences also affect sustainable consumption. Peer norms and family values can encourage green behavior, particularly in cultures where environmental practices are socially reinforced (Yoon & Joung, 2019, 5; Szopinski & Szwajca, 2021, 17). When formal education is concerned, many students report limited exposure to sustainability-related content within their academic curricula and instead rely on informal sources such as social media or peer networks (Sonnenberg et al., 2014, 341; Kakalia, 2022, 10). However, when environmental education is integrated - especially with experiential or community-based approaches - it can significantly influence behavior (Lee & Hung, 2024, 9; Chuvieco et al., 2018, 502). Online platforms, influencers, and brand websites serve as primary sources of information about green products (Chen et al., 2020; Goh & Balaji, 2016). While these channels increase accessibility of information, they also raise concerns regarding credibility and information overload. Cross-cultural comparisons reveal substantial differences in how students perceive and engage with sustainability. For instance, Chuvieco et al. (2018, 503) show that environmental habits differ widely among Spanish, Chilean, and Italian students, depending on cultural values, institutional frameworks, and national policies. Trust in sustainability claims is a recurring theme in consumer research. When students perceive companies as genuinely environmentally responsible, they are more likely to engage with them and prefer their products (Nguyen et al., 2017, 78; Lin et al., 2023, 12). The emotional dimension, such as feelings of alignment with the brand's mission, also plays a significant role (Watchravesringkan et al., 2023, 13). Rambandara & Dilanthi (2024) published a comprehensive literature review on the factors influencing university students' intentions to purchase green products. The review emphasizes the importance of studying student populations due to their potential to shape sustainable market trends and their role in green entrepreneurship. The authors propose a conceptual framework identifying five main factors that positively influence green purchase intentions: environmental attitudes (personal beliefs, values, and emotional responses related to environmental protection), product attributes (how consumers perceive the price, quality, availability, and credibility of green products), social influence (the role of social norms, peers, family, and the broader community), personal experience (individual experiences with environmentally friendly products and past purchasing history) and environmental knowledge (the level of awareness and understanding of sustainability concepts, eco-labels, and the environmental impact of consumption). In addition, they highlight other influencing factors such as personal values, perceived consumer effectiveness, trust, price sensitivity, and product availability. In conclusion, the literature points to the fact that promoting sustainable consumption to university students requires a multidimensional approach that integrates education, marketing, and supportive policy interventions (Rambandara & Dilanthi, 2024).

3. Methodology

3.1. Aim of the Research and Research Questions

The aim of this research is to provide insights into the role of sustainability in shaping consumer behavior among university students in Osijek, Croatia. The study aims to answer the following research questions:

1. How much do students know about sustainability and sustainable practices?
2. How important is sustainability to students when making purchasing decisions?
3. How do students gather information about sustainable practices and products?

4. What are the obstacles that prevent students from choosing sustainable products and services?
5. What is the relationship between students' sustainability-related knowledge, attitudes, trust in sustainability information, and their sustainable consumption behaviors?

3.2. Sample

The research sample consisted of a stratified sample of 193 undergraduate and graduate students at the University of Osijek, i.e. its constituents: Faculty of Humanities and Social Sciences; Faculty of Electrical Engineering, Computer Science and Information Technology; Faculty of Food Technology; Faculty of Education; and Faculty of Applied Mathematics and Informatics. A total of 234 respondents participated in the questionnaire, out of which 193 (82.5%) completed it in its entirety.

3.3. Research Instrument

The research instrument used in this study was a 12-item online questionnaire designed to assess students' knowledge about sustainability, their attitudes towards sustainable practices, as well as their methods for gathering information, and making decisions regarding sustainable products and services. The content of the questionnaire is grounded in relevant scientific literature addressing the factors that influence the intention to purchase sustainable (i.e., green) products, particularly among the student population. The questionnaire is informed by the findings of a systematic review conducted by Rambandara and Dilanthi (2024), which provides a comprehensive overview of the variables involved in modeling green consumer behavior among young people, as explained in the Literature review section. Identified variables (environmental knowledge, environmental attitudes, experience, informational influence, contextual barriers) are reflected in the structure of the questionnaire through different sets of questions. In this way, the questionnaire enables a multidimensional examination of sustainable consumption and is aligned with key findings from existing research, with a particular emphasis on young consumers as a strategically important group. The questionnaire did not follow the research questions sequentially. Each question or part of it was linked to a specific research question to ensure comprehensive data collection. Research question 1 (RQ1) included items assessing students' prior exposure to sustainability education, familiarity with key terms (e.g. *circular economy* and *carbon footprint*), recognition of eco-labels (e.g. *Fair Trade* and *EU Ecolabel*), and self-assessed understanding of sustainable products and decision-making. RQ2 included questions that explored the frequency of students' attention to eco-certifications during purchases, efforts to seek sustainable options, and agreement with statements about supporting sustainable brands and personal responsibility. RQ3 covered the items in which the students were asked to identify their information sources about sustainability (e.g. social media and school) and evaluate their trust in corporate sustainability claims. Finally, RQ4 included items addressing the challenges students face in this context, such as distinguishing genuine sustainable products from greenwashing, financial constraints, etc.; and their suggestions for promoting sustainable choices. The questionnaire was delivered via *LimeSurvey*, ensuring anonymity for all responses. It was distributed through lecturers at the faculties via e-mail, with some facilitating its completion during class sessions, which minimized non-participation rates compared to indirect distribution channels such as email. The collected data was statistically analyzed with SPSS v26 and presented in terms of descriptive statistics.

4. Results

4.1. Respondents' Demographic Profile

Table 1 presents the demographic profile of the respondents. The sample consisted of 193 students, of whom 29% were male (N=56) and 71% were female (N=137). The majority of the students were at the undergraduate level, with 40.4% in their first year (N=78), 24.4% in their second year (N=47), and 29% in their third year (N=56). A notably smaller proportion were graduate students, with 0.5% in their first year (N=1) and 5.7% in their second year (N=11). Most of the participants were enrolled at the Faculty of Humanities and Social Sciences (N=93; 48.2%), followed by the Faculty of Education (N=40; 20.7%), the Faculty of Electrical Engineering, Computer Science and Information Technology (N=22; 11.4%), the Faculty of Food Technology (N=20; 10.4%), and the Faculty of Applied Mathematics and Informatics (N=18; 9.3%).

Table 1: The Respondents' Demographic Profile

Variable	Classification	Value	
		N	%
Gender	Female	137	71
	Male	56	29
Study Year	1st year undergraduate	78	40.4
	2nd year undergraduate	47	24.4
	3rd year undergraduate	56	29
	1st year graduate	1	0.5
	2nd year graduate	11	5.7
Faculty	Faculty of Humanities and Social Sciences	93	48.2
	Faculty of Education	40	20.7
	Faculty of Electrical Engineering, Computer Science and Information Technology	22	11.4
	Faculty of Food Technology	20	10.4
	Faculty of Applied Mathematics and Informatics	18	9.3

Source: Authors

4.2. Students' Knowledge of Sustainability and Sustainable Practices

When asked whether they had ever attended a faculty course or participated in another type of program on sustainability, the majority of students (N=144; 74.6%) reported that they had not taken part in such activities.

Table 2 presents the students' familiarity with terms related to sustainability and sustainable practices. Students' knowledge of these concepts varies, with *zero waste* being the most widely recognized one (N=141; 73.1%), followed by *bioplastics* (N=126; 65.3%), and *carbon footprint* (N=107; 55.4%). In contrast, less than a third of students (N=59; 30.6%) knew what *greenwashing* was, while concepts such as *circular economy* (N=41; 21.2%) and *regenerative agriculture* (N=38; 19.7%) were even less familiar to the students. The least recognized term was *permaculture*, with only several (N=19; 9.8%) students reporting to have been acquainted with it.

Table 2: Students' Familiarity with Sustainability-Related Concepts

Concept	N	%
Zero waste	141	73.1
Bioplastics	126	65.3
Carbon footprint	107	55.4
Greenwashing (misleading environmental claims)	59	30.6
Circular economy	41	21.2
Regenerative agriculture	38	19.7
Permaculture	19	9.8

Source: Authors

When asked about which ecological certificates or labels they are familiar with, students have shown varying degrees of knowledge (Table 3). The most recognized certificate is *EU Organic*, with nearly half of the students (N=96; 49.7%) indicating familiarity. This is followed by *Fair Trade*, known to 44% (N=85) students. Certificates such as *Climate Neutral* (N=62; 32.1%), and *Rainforest Alliance* (N=57; 29.5%) are also moderately recognized. On the other hand, less familiar certificates/labels include *EU Ecolabel* (N=46; 23.8%) and *Energy Star* (N=23; 11.9%), while the least recognized one is *FSC (Forest Stewardship Council)* (N=17; 8.8%). These results indicate that students' knowledge of ecological certificates is relatively poor since each label was recognized by less than 50% of the respondents. Students who had attended a sustainability-related course reported significantly higher confidence in recognizing ecological certificates (Mann-Whitney U = 2869, p = 0.044).

Table 3: Students' Familiarity with Ecological Certificates/Labels

Ecological certificate/label	N	%
EU Organic	96	49,7
Fair Trade	85	44
Climate Neutral	62	32,1
Rainforest Alliance	57	29,5
EU Ecolabel	46	23,8
Energy Star	23	11,9
FSC (Forest Stewardship Council)	17	8,8

Source: Authors

In relation to the degree of agreement (Table 4) with sustainability-related statements pertaining to their knowledge on the topic, the students demonstrated varying levels of agreement. We see strong agreement with the statement *I understand the difference between sustainable and non-sustainable products* with 73% (N=141) of students agreeing or strongly agreeing. This contrasts the response *I can recognize ecological certificates, such as Fair Trade, EU Ecolabel, or FSC* where more than a half of students (52.9%, N=102) reported a certain level of disagreement. Similarly, only 50,7% (N=98) of students agreed or strongly agreed with the statement *I feel I have enough knowledge to make sustainable purchasing decisions* which suggests gaps in concrete purchasing decisions despite moderate overall confidence in knowledge. Two thirds of respondents (68.4%, N=132) agreed completely or to a certain level with the statement *I would like to learn more about sustainability*, while only 6.8% (N=13) expressed some level of disagreement. These results indicate that while students for the most part feel confident in identifying sustainable products, more than a half do not feel they have enough knowledge for sustainable purchasing and they struggle with recognizing ecological

certifications, however their interest in learning more about sustainability is high in the majority of our sample.

Table 4: Students' Attitudes and Self-Perceptions Regarding Sustainability Knowledge and Practices

Statement	Frequency Distribution N (%)*				
	1	2	3	4	5
I understand the difference between sustainable and non-sustainable products.	4 (2.1)	9 (4.7)	39 (20.2)	101 (52.3)	40 (20.7)
I can recognize ecological certificates, such as Fair Trade, EU Ecolabel, or FSC.	55 (28.5)	47 (24.4)	45 (23.3)	37 (19.2)	9 (4.7)
I feel I have enough knowledge to make sustainable purchasing decisions.	7 (3.6)	33 (17.1)	55 (28.5)	79 (40.9)	19 (9.8)
I would like to learn more about sustainability.	9 (4.7)	4 (2.1)	48 (24.9)	77 (39.9)	55 (28.5)

*1 - Completely disagree; 5 - Completely agree

Source: Authors

Female students showed significantly higher willingness to learn more about sustainability ($p < 0.01$).

4.3. The Role of Sustainability in Students' Purchasing Decisions

Table 5 shows the students' frequency of paying attention to certificates and searching for sustainable options during purchasing decisions. For the question *How often do you pay attention to certificates when purchasing products*, the majority of students (N=111; 57.5%) do so never or rarely, while only 8.8% (N=17) reported frequently paying attention to certificates, with no students indicating that they always do so. Similarly, for the question *How often do you search for sustainable options or additional information about sustainability before making a purchasing decision*, a notable proportion of students (N=134; 69.4%) reported to doing so either never or rarely, while only 5.7% (N=11) do it very often or always. These findings show a general lack of engagement with sustainability considerations during purchasing decisions.

Table 5: Frequency of Paying Attention to Certificates and Searching for Sustainable Options During Purchasing Decisions

Question	Frequency Distribution N (%)*				
	1	2	3	4	5
How often do you pay attention to certificates when purchasing products?	46 (23.8)	65 (33.7)	65 (33.7)	17 (8.8)	0 (0)
How often do you search for sustainable options or additional information about sustainability before making a purchasing decision?	67 (34.7)	67 (34.7)	48 (24.9)	10 (5.2)	1 (0.5)

*1 - Never; 5 - Always

Source: Authors

When asked about their degree of agreement (Table 6) with sustainability-related statements pertaining to their purchasing decisions, the students demonstrated generally positive views. For the statement *It is important to support manufacturers and brands that have sustainable practices*, the majority of students (N=163; 84.4%) agreed or strongly agreed, with only 4.6%

(N=9) expressing a certain level of disagreement. Similarly, for the statement *I feel a responsibility as a consumer to protect the environment*, 63.7% (N=123) agreed or strongly agreed, while 12.4% (N=24) expressed disagreement. The statement *I believe that my individual purchasing decisions can contribute to environmental protection* also showed relatively strong levels of agreement (N=112; 58%), while 16.6% (N=32) expressed disagreement. These results suggest that students generally recognize the importance of supporting sustainable practices and feel a sense of responsibility as consumers, however during their purchasing decisions they do not act on these beliefs.

Table 6: Students' Attitudes and Self-Perceptions Regarding Sustainability Knowledge and Practices

Question	**Frequency Distribution N (%)***				
	1	**2**	**3**	**4**	**5**
It is important to support manufacturers and brands that have sustainable practices.	2 (1)	7 (3.6)	21 (10.9)	90 (46.6)	73 (37.8)
I feel a responsibility as a consumer to protect the environment.	7 (3.6)	17 (8.8)	46 (23.8)	78 (40.4)	45 (23.3)
I believe that my individual purchasing decisions can contribute to environmental protection.	12 (6.2)	20 (10.4)	49 (25.4)	82 (42.5)	30 (15.5)

*1 - Completely disagree; 5 - Completely agree

Source: Authors

Female students showed significantly higher pro-sustainability attitudes and behaviors. They had stronger sense of responsibility, and more frequent information-seeking before purchase ($p < 0.01$).

4.4. Sources of Information on Sustainability and Perceived Level of Trust

Table 7 shows students' information sources on sustainability and environmental protection. The most frequently used sources were *high school* (N=145; 75.1%) and *media and online portals* (N=142; 73.6%), followed by *social media platforms* (N=133; 68.9%), suggesting that formal secondary education and digital platforms play the biggest role in the dissemination of sustainability-related information. In contrast, fewer students reported encountering such information in *elementary school* (N=102; 52.8%) or *faculty/university* (N=81; 42%). Among informal sources, *documentary films* (N=64; 33.2%) and *conversations with family and friends* (N=27; 16.6%) were employed by a minority of students, while *brand websites* were cited by only 14% (N=27) students, which implies limited student engagement with the corporate domain online. The respondents had the option to mention their own sources, out of which *Erasmus+ programs*, *Google*, *YouTube* and *practical work* (N=3; 1.5%) were mentioned. These results emphasize how widely accessed online platforms can be used to further promote sustainability, but also serve to raise awareness of certain gaps in primary and tertiary education in terms of education in sustainability and environmental protection.

Table 7: Information Sources for Gathering Knowledge on Sustainable Practices and Products

Information Source	N	%
High school	145	75.1
Media and online portals	142	73.6
Social media (Instagram, TikTok, Facebook etc.)	133	68.9
Elementary school	102	52.8
Faculty/university	81	42
Documentary films	64	33.2
Brand websites	27	14
Conversations with family and friends	32	16.6
Other sources	3	1.5

Source: Authors

The results in Table 8 show strong opinions and attitudes among students regarding sustainability education, corporate practices, and trust in sustainability-related information. For the statement *I believe that educational institutions should provide more education on sustainability*, the majority of students (N=152; 78.7%) agreed or strongly agreed, with only 3.7% (N=7) expressing disagreement. This shows widespread support for increased sustainability education within academic settings. For the statement *How often do you think companies use sustainability as a marketing trick*, nearly two thirds of the students (N=120; 62.2%) believed this happens often or always, while only 5.7% (N=11) thought it rarely or never occurs, suggesting a high degree of skepticism among students in terms of the authenticity of corporate sustainability claims and information. Furthermore, when asked *How much do you trust the information about sustainability provided by companies*, less than a quarter of students (N=45; 23.8%) expressed a certain degree of trust, while a significant majority (N=147; 76.2%) reported low levels of trust or no trust at all. This shows a notable distrust in corporate communication and information about sustainability. Overall, these results suggest that students are critical of corporate practices they perceive as insincere, and they also exhibit a considerable amount of distrust toward corporate messaging on these topics. This suggests a need for sustainability education to include training in assessing the credibility of sustainability-related information. Notably, over two-thirds of students agreed that educational institutions should provide more education on sustainability.

Table 8: Students' Beliefs and Perceptions Regarding Sustainability and Corporate Practices

Question	Frequency Distribution N (%)				
	1	2	3	4	5
I believe that educational institutions should provide more education on sustainability.*	4 (2.1)	3 (1.6)	34 (17.6)	68 (35.2)	84 (43.5)
How often do you think companies use sustainability as a marketing trick?**	4 (2.1)	7 (3.6)	62 (32.1)	93 (48.2)	27 (14)
How much do you trust the information about sustainability provided by companies?***	12 (6.2)	39 (20.2)	96 (49.7)	45 (23.3)	1 (0.5)

*1 - I completely disagree; 5 - I completely agree
** 1 - Never; 5 - Always
*** 1 - I do not trust it at all; 5 - I completely trust it

Source: Authors

Male students were more likely to believe that sustainability is used as a marketing trick (p = 0.014).

4.5. Barriers to Choosing Sustainable Products and Services

Table 9 shows students' perceptions on barriers to choosing sustainable products. For the statement *I am unsure how sustainable products specifically contribute to environmental protection*, a majority (N=114; 59.1%) of students disagreed or strongly disagreed, while only 21.2% (N=41) expressed agreement to some degree. This suggests that most students feel fairly confident in understanding the environmental benefits of sustainable products. For the statement *Sustainable products are too expensive for my current financial situation*, a significant number of students (N=138; 71.5%) agreed or strongly agreed, with only 11.9% (N=23) disagreeing to some extent. These results show that cost is perceived as a major barrier to adopting sustainable products. Furthermore, for the statement *I am unsure how to distinguish truly sustainable products from those that only claim to be environmentally friendly (greenwashing)*, 72% of students (N=139) agreed or strongly agreed, while only 17.6% (N=34) expressed disagreement. This implies fairly great concern about greenwashing and difficulty in identifying genuinely sustainable products. These results suggest that while students generally understand the benefits of sustainable products, financial constraints and skepticism about greenwashing greatly impede their ability to make legitimate sustainable choices.

Table 9: Students' Perceptions of Barriers to Choosing Sustainable Products and Services

Question	Frequency Distribution N (%)*				
	1	**2**	**3**	**4**	**5**
I am unsure how sustainable products specifically contribute to environmental protection.	36 (18.7)	78 (40.4)	38 (19.7)	35 (18.1)	6 (3.1)
Sustainable products are too expensive for my current financial situation.	7 (3.6)	16 (8.3)	86 (44.6)	52 (26.9)	32 (16.6)
I am unsure how to distinguish truly sustainable products from those that only claim to be environmentally friendly (greenwashing).	11 (5.7)	23 (11.9)	78 (40.4)	59 (30.6)	22 (11.4)

*1 - Completely disagree; 5 - Completely agree

Source: Authors

Table 10 shows the factors that students believe would encourage them to choose sustainable products and services more frequently. The most commonly selected factor was *lower prices for sustainable products* (N=150; 77.7%), indicating the significance of affordability in influencing sustainable purchasing decisions. This was followed by *better availability of sustainable products in stores* (N=123; 63.7%) and *clearer labels and certifications on products* (N=118; 61.1%), noting that accessibility and transparency are also critical in this sense. Approximately half of the respondents emphasized the need for a *better understanding of the actual impact of sustainable products on the environment* (N=99; 51.3%) and *more information about sustainability and its benefits* (N=96; 49.7%), suggesting that knowledge gaps are a barrier to students' sustainable consumption. Trusting corporate claims was also a fairly notable concern, with 44.6% (N=85) of respondents remarking that *greater trust in companies' ecological claims* would encourage them to make more sustainable choices. Less frequent factors include introducing *sustainability topics into educational programs* (N=71; 36.8%) and *recommendations from friends and family* (N=33; 17.1%). These results emphasize the need for

addressing economic, informational and trust-related issues, which would ideally result in more widespread adoption of sustainable consumption behavior among students.

Table 10: Factors Influencing Students' Choosing of Sustainable Products and Services

Factor	N	%
Lower prices for sustainable products	150	77.7
Better availability of sustainable products in stores	123	63.7
Clearer labels and certifications on products	118	61.1
Better understanding of the actual impact of sustainable products on the environment	99	51.3
More information about sustainability and its benefits	96	49.7
Greater trust in companies' ecological claims	85	44.6
Introducing sustainability topics into educational programs	71	36.8
Recommendations from friends and family	33	17.1

Source: Authors

4.6. Relationship between sustainability-related knowledge, attitudes, trust in sustainability information, and sustainable consumption behaviors?

All three behavioral indicators - having a habit of checking the origin of the products, paying attention to certificates when purchasing, and searching for sustainable options or additional information before purchase - were strongly intercorrelated (ρ = 0.537 - 0.655, $p < 0.01$), suggesting consistency in sustainable consumer behavior. These behaviors were also moderately correlated with sustainability-related attitudes. The strongest association was observed between *searching for sustainable options* and the belief that *individual purchasing decisions can contribute to environmental protection* ($\rho = 0.445$, $p < 0.01$), as well as with *a sense of consumer responsibility* ($\rho = 0.406$, $p < 0.01$). Weaker but significant correlations were also found between all three behaviors and the belief that *it is important to support manufacturers and brands that have sustainable practices* (ρ = 0.147 - 0.182, $p < 0.05$). Regarding knowledge and behavior, the ability to *recognize ecological certificates* demonstrated the strongest correlations with all three behavioral indicators (ρ = 0.371 - 0.401, $p < 0.01$), while other knowledge items, such as *feeling knowledgeable enough to make sustainable purchasing decisions*, also positively correlated with sustainable actions, particularly *searching for sustainable options* ($\rho = 0.235$, $p < 0.01$).
The analysis of knowledge and attitudes revealed a weak but significant positive relationship between *understanding the difference between sustainable and non-sustainable products* and both *a sense of responsibility* and *support for sustainable brands* (ρ = 0.199 - 0.219, $p < 0.01$). Uncertainty about sustainability impacts showed significant negative correlations with all attitude items (ρ = -0.156 to - 0.250, $p < 0.05$ or $p < 0.01$), suggesting that greater clarity supports more positive attitudes. In terms of trust, *trust in information provided by companies* was positively associated with all three behaviors (ρ = 0.261 - 0.397, $p < 0.01$) and with core attitudes, including *belief in individual impact* ($\rho = 0.335$, $p < 0.01$) and *a sense of responsibility* ($\rho = 0.282$, $p < 0.01$). Overall, the results demonstrate that knowledge, positive attitudes, and trust are significantly linked to sustainable behavior. Students who are more informed, and value their own role as responsible consumers are more likely to act in line with sustainable consumption principles.

5. Discussion

The results of this study align with previous studies pointing to a significant gap between university students' pro-environmental attitudes and their actual consumption behavior. Consistent with previous findings (Sonnenberg et al., 2014; Heo & Muralidharan, 2017; Rambandara & Dilanthi, 2024), students generally express strong support for sustainability and feel a sense of responsibility as consumers. However, this is not consistently translated into everyday purchasing decisions. The data indicates that students rarely pay attention to ecological certifications or seek additional sustainability-related information prior to making purchases, despite claiming to understand the differences between sustainable and non-sustainable products. One key finding is the limited sustainability knowledge among students. While highly publicized concepts like "zero waste" and "bioplastics" are widely recognized, more technical or policy-oriented terms (e.g., "permaculture," "regenerative agriculture," "circular economy") are much less familiar. Similar conclusions apply to awareness of eco-labels, with only two certificates (EU Organic and Fair Trade) being recognized by nearly half of the sample. These findings confirm earlier observations about the fragmented nature of students' sustainability knowledge (Rambandara & Dilanthi, 2024; Szaban & Stefańska, 2023). Barriers to sustainable consumption reported in this study strongly reflect those documented in the literature. Price sensitivity emerged as the most cited obstacle, consistent with studies showing that economic constraints are particularly impactful for young consumers (Tran et al., 2022; George & Silva, 2022). Additionally, more than two-thirds of students expressed difficulty in distinguishing between genuine sustainability efforts and greenwashing, suggesting a pronounced credibility gap in corporate communication, as emphasized by Chen et al. (2020) and Watchravesringkan et al. (2023). This skepticism was further reinforced by low levels of trust in corporate sustainability claims, with only one in four students reporting any degree of trust. Information sources also reflect patterns observed in prior studies. High school education and digital media platforms (social media, online portals) were identified as primary sources of sustainability-related information, while university courses played a comparatively minor role. This points to a missed opportunity in higher education settings to build comprehensive and critically informed sustainability competencies (Chuvieco et al., 2018; Lee & Hung, 2024). Notably, students overwhelmingly expressed a desire for more sustainability education within academic institutions. Students identified lower prices, clearer product labeling, and greater product availability as key drivers that could enhance their ability to act in line with their values. These suggestions also appear in policy recommendations from broader literature, which advocate for integrative strategies combining education, infrastructure, and transparency (Rambandara & Dilanthi, 2024; Nichifor et al., 2025). Gender-based differences further illustrate how sustainability engagement varies across the student population. Female students demonstrated significantly higher pro-sustainability attitudes and behaviors compared to their male peers. They showed a stronger willingness to learn more about sustainability, a heightened sense of consumer responsibility, and more frequent searching for sustainability-related information before making purchases (all $p < 0.01$). In contrast, male students were significantly more likely to believe that sustainability is used primarily as a marketing trick ($p = 0.014$). These findings reflect patterns observed in previous research suggesting that women are more inclined toward socially responsible and environmentally conscious behavior, while men tend to exhibit greater skepticism toward institutional or corporate sustainability narratives (Chang & Watchravesringkan, 2018; Nguyen et al., 2017). Additional analysis provided further insight into the interconnections between knowledge, attitudes, trust, and behavior. All three behavioral indicators - checking product origin, paying attention to certificates, and searching for sustainable options - were strongly interrelated. These behaviors were also moderately associated with attitudes, particularly the

belief that individual consumption choices can contribute to environmental protection and a sense of consumer responsibility. These findings support theoretical models such as the Theory of Planned Behavior, which emphasize the role of attitudes and perceived control in predicting action (Ajzen, 1991; Zhuang et al., 2021). The ability to recognize ecological certificates showed the strongest correlation with all three behavioral indicators. In contrast, students who felt unsure about how sustainable products contribute to environmental protection or how to identify credible claims were less likely to hold strong sustainability related attitudes. Trust also emerged as a significant factor in shaping both attitudes and behaviors. Students who expressed greater trust in corporate sustainability information were significantly more likely to report sustainable purchasing behavior and stronger belief in their individual impact. Overall, the findings of this study support a multidimensional view of sustainable consumption, in which informed, confident, and trusting individuals are more likely to act sustainably. To support such engagement, interventions should simultaneously target the improvement of sustainability-related knowledge, the strengthening of pro-environmental attitudes, and the credibility of information communicated by companies and institutions.

6. Conclusion

This study provides important insights into the factors that shape sustainable consumption behavior among university students. The findings demonstrate that although students generally express strong pro-sustainability attitudes and a sense of personal responsibility, these values are not always reflected in their actual consumer behavior. Engagement in sustainable actions such as checking product origin, paying attention to certifications, and searching for additional sustainability information, is limited to a smaller portion of the student population. Furthermore, these behaviors tend to be strongly interrelated and associated with higher levels of knowledge, trust in sustainability information, and confidence in individual responsibility and impact. The ability to recognize eco-certifications emerged as a key factor related to sustainable purchasing, underlining the importance of targeted and practical knowledge. Furthermore, students who trusted information provided by companies were more likely to exhibit more positive sustainability attitudes and behaviors, although general trust in corporate sustainability claims was relatively low. The results also revealed gender differences: female students were more likely to seek information, express responsibility, and engage in sustainable behaviors, whereas male students showed higher levels of skepticism. These findings highlight several practical implications. Educational institutions should integrate sustainability education more comprehensively across disciplines and focus not only on raising awareness but also on reducing uncertainty and developing critical information literacy. In parallel, companies need to communicate their sustainability initiatives in transparent, verifiable, and consistent ways to foster trust and engagement. Policies aiming to support sustainable consumption among young people should address barriers such as affordability and availability of sustainable products. The study has several limitations. First, the sample was limited to students from a single Croatian university, which constrains the generalizability of the findings. Cultural, institutional, and regional factors may influence students' experiences and behaviors. Second, the study relied on self-reported data, which may be subject to social desirability bias. Future research should expand the sample to include students from multiple universities and academic fields to enable comparative analysis and generalization of the results. A mixed-method approach combining quantitative and qualitative data could also offer deeper insights into students' motivations, experiences, and perceived barriers. Understanding these factors is essential for designing more effective educational, institutional, and corporate strategies to support responsible consumer behavior among younger generations.

REFERENCES

Ali, H., Li, M., & Hao, Y. (2021): ***Purchasing Behavior of Organic Food among Chinese University Students***. Sustainability, 13(5464), 1–17.

Chang, H. J., & Watchravesringkan, K. T. (2018): ***Who are sustainably minded apparel shoppers? An investigation to the influencing factors of sustainable apparel consumption***. International Journal of Retail & Distribution Management, 46(2), 148–162. https://doi.org/10.1108/IJRDM-10-2016-0176

Chen, X., Sun, X., Yan, D., & Wen, D. (2020): ***From Perceived Sustainability to Customer Engagement in Online Shopping Environment: The Rational and Emotional Perspectives***. Sustainability, 12(2674), 1–16. https://doi.org/10.3390/su12072674

Chuvieco, E., Burgui, M., Da Silva, E. V., Hussein, K., & Alkaabi, K. (2018): ***Factors Affecting Environmental Sustainability Habits of University Students: Intercomparison Analysis in Three Countries (Spain, Brazil and UAE).*** Journal of Cleaner Production. https://doi.org/10.1016/j.jclepro.2018.07.121

George, H. I. C., & Silva, H. P. T. N. (2022): ***Factors Affecting Awareness and Attitudes on the Green Purchase Intention of Eco-friendly Products in University Students***. International Journal of Research and Innovation in Social Science (IJRISS), 6(2), 592–598.

Kamenidou, I. C., Mamalis, S. A., Pavlidis, S., & Bara, E.-Z. G. (2019): ***Segmenting the Generation Z Cohort University Students Based on Sustainable Food Consumption Behavior: A Preliminary Study***. Sustainability, 11(837), 1–19. https://doi.org/10.3390/su11030837

Lee, C.-W., & Hung, H.-H. (2024): ***The Impact of Education on Consumers' Eco-Friendly Shopping Habits towards Sustainable Purchases: Evidence from Indonesia and Taiwan***. Sustainability, 16(8832), 1–30. https://doi.org/10.3390/su16208832

Mouloudj, K., & Bouarar, A. C. (2021): ***The Impact of Word of Mouth on Intention to Purchase Green Products: An Empirical Study***. Revue Algérienne d'Economie et Gestion, 15(1), 871–890.

Nakaishi, T., & Chapman, A. (2024): ***Eco-labels as a communication and policy tool: A comprehensive review of academic literature and global label initiatives.*** Renewable and Sustainable Energy Reviews, *202*, 114708.

Nguyen, T. N., Lobo, A., & Nguyen, B. K. (2017): ***Young consumers' green purchase behavior in an emerging market.*** Journal of Strategic Marketing. https://doi.org/10.1080/0965254X.2017.1318946

Nichifor, B., Zait, L., & Timiras, L. (2025): ***Drivers, Barriers, and Innovations in Sustainable Food Consumption: A Systematic Literature Review***. Sustainability, *17*(5), 2233. https://doi.org/10.3390/su17052233

Rambandara, R. D. S. S., & Dilanthi, M. G. S. (2024): ***Purchase Intentions of the University Students Toward Green Products: A Literature Review***. International Journal of Education and Research, 12(6), 71–83.

Sonnenberg, N., Jacobs, B., & Momberg, D. (2014): ***The Role of Information Exposure in Female University Students' Evaluation and Selection of Eco-Friendly Apparel in the South African Emerging Economy***. Journal of Family Ecology and Consumer Sciences, 42, 66–78.

Szaban, M., & Stefańska, M. (2023): ***Green Consumption Process in the Face of the Knowledge Barrier: Polish Residents' Perspective***. Economics and Environment, 2(85), 448–455. https://doi.org/10.34659/eis.2023.85.2.570

Tran, K., Nguyen, T., Tran, Y., Nguyen, A., Luu, K., & Nguyen, Y. (2022): ***Eco-friendly fashion among Generation Z: Mixed-methods study on price value image, customer fulfillment, and pro-environmental behavior***. PLOS ONE, 17(8), e0272789. https://doi.org/10.1371/journal.pone.0272789

United Nations. (n.d.): ***The 17 goals.*** United Nations. https://sdgs.un.org/goals

Usmani, S., Kumari, K., Husain, J., & Jamal, S. (2015): ***Consumers' Perception and Purchase Intentions Toward Green Products: Exploring the attitude among Pakistani consumers***. In Proceedings of the Second International Conference on Education, Social Science, and Humanities.

Yoon, J., & Joung, S. (2019): ***Examining Purchase Intention of Eco-Friendly Products: A Comparative Study***. Journal of System and Management Sciences, 9(3), 123–135. https://doi.org/10.33168/JSMS.2019.0308

Zhuang, W., Luo, X., & Riaz, M. U. (2021): ***On the Factors Influencing Green Purchase Intention: A Meta-Analysis Approach***. Frontiers in Psychology, 12, 644020. https://doi.org/10.3389/fpsyg.2021.644020

A scientific paper

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WORK-FAMILY BALANCE, CHILDCARE SUPPORT, AND EMPLOYMENT STATUS: A HOUSEHOLD PERSPECTIVE

ABSTRACT

Balancing work and family responsibilities is crucial to understanding individual employment decisions and broader demographic trends. Adopting a household perspective to investigate employment correlates is vital for developing effective social policies, particularly within specific national contexts like Croatia. This paper aimed to investigate the association between individual employment status and a range of factors including demographic characteristics, partner's employment status, satisfaction with household and childcare task sharing, the use of informal childcare support networks, and attitudes towards work-family balance, using The Generations and Gender Programme (GGP) Round II – Wave 1 data.

The analysis revealed strong associations within the household context. Having an employed partner significantly increased the odds of respondent employment, while not receiving regular informal childcare support from relatives/friends significantly decreased the odds. Standard demographic effects were confirmed: age was positively associated with employment odds and females had significantly lower odds than males. Attitudes reflecting confidence in work-family balance also correlated positively with employment in related analyses.

The findings emphasize the important influence of dyadic factors, especially the partner's employment and informal support networks on an individual's employment status, alongside demographic characteristics. They offer a more nuanced insight into work-family dynamics within households and stress the importance of policies that tackle gender inequality and support working families by accounting for the interaction between formal provisions, informal support systems, and internal household arrangements.

Keywords: *Generations and Gender Programme, labor market participation, work-family balance, childcare support.*

1. Introduction

High labor force participation is not only a matter of individual economic empowerment but is also crucial for broader economic growth and fiscal sustainability, particularly as populations

age. Consequently, governments and researchers in developed economies have directed extensive attention to how childcare costs and the balance between work and family life influence individuals' decisions to participate in the labor market. In contemporary European societies, navigating the complexities of the labor market is often intertwined with family life, presenting challenges related to work-family balance, gender equality, and the utilization of support systems. While demographic characteristics are known predictors, a comprehensive understanding requires exploring how factors within the household, individual attitudes towards life choices, and available support networks collectively shape employment outcomes. This is particularly relevant in contexts facing demographic pressures such as population aging and low fertility, where maximizing labor force participation while supporting family formation is a key policy goal. Therefore, this paper addresses the following research question: How do household dynamics (including partner's employment and satisfaction with task sharing), access to informal support networks, and attitudes towards the parenthood relate to individual employment status?

The relationship between childcare, work-family balance, and labor market participation has been widely examined, with an emphasis on how these factors impact women's employment decisions and overall economic outcomes. Extensive research has established the strong influence of core demographic factors – notably age, gender, and educational attainment – on labor force participation and employment status (Becker, 1965; Blau & Robins, 1989; Blau & Kahn, 2007). Economic conditions and labor market structures are also recognized as determinants. Within the family context, the employment status of one's partner is known to be a significant correlate, often explained through theories of assortative mating and household economic decision-making (Schwartz & Mare, 2012). Furthermore, the availability and generosity of formal family policies, such as parental leave and public childcare, have been widely studied for their impact on parental, particularly maternal, employment (Thévenon, 2011).

However, several gaps remain. Firstly, while the impact of actual parenthood is well-documented, less research has integrated individuals' subjective attitudes and expectations regarding the potential consequences of having children – such as perceived financial impacts, foreseen challenges in work-family balance, or expectations about childcare and leave availability – into models predicting their current employment status. These attitudes may shape career decisions and labor market attachment even before parenthood occurs. Secondly, the interplay between dynamics within the household, such as satisfaction with the division of domestic labor (both household chores and childcare), and individual employment status warrants further investigation, particularly how it interacts with partner characteristics. Thirdly, while formal support systems are often studied, the role of informal support networks, such as regular childcare assistance from relatives or friends, may be crucial, especially in contexts where formal services are limited or costly, yet it is not always included alongside dyadic and attitudinal factors.

This paper aims to contribute to a more holistic understanding of employment status by simultaneously examining the association between individual employment and a multifaceted set of predictors. We investigate not only standard demographic controls (age, gender) but also partner characteristics (employment status), subjective assessments of household dynamics (satisfaction with task sharing), reliance on informal support networks (childcare help from relatives/friends), and crucially, individuals' attitudes regarding the perceived impact of potential parenthood on finances, work-life balance, and the perceived availability of childcare and leave. Using logistic regression analysis applied to The Generations and Gender

Programme (GGP) Round II (Wave 1) dataset, this paper analyzes these factors collectively. By doing so, we aim to fill the identified research gaps and provide a nuanced perspective on how individual perceptions, household interactions, and informal support systems, in addition to demographic factors, correlate with employment outcomes. The findings intend to offer insights relevant for both demographic research on work-family dynamics and evidence-based social policy development.

2. Literature review

Childcare, work-family balance and perceived career trade-offs associated with parenthood significantly influence employment status, particularly for mothers, because they are usually considered as the primary care providers for their children. A large body of research indicates that higher childcare costs are associated with a lower probability of mothers participating in the labor force (Kimmel, 1998; Connelly, 1992; Bauernschuster & Schlotter, 2015; Cascio 2009; Blau & Robins, 1988; Boeckmann et al., 2015). According to Givord & Marbot (2015) this is because the cost of childcare can be significant and that can act as an obstacle to labor force participation.

Work-family policies, such as parental leave and childcare services, play a crucial role in balancing work and family life and thus influence their employment status. According to Boeckmann et al. (2015) key findings on parental leave suggest that more fully paid weeks are linked to lower maternity gap in employment participation, whereas length of leave is associated with a larger gap, likely due to lost job experience. Furthermore, Boeckmann et al. (2015) found that publicly provided childcare can help reduce work-family conflict and allow mothers of young children to maintain employment by providing a reliable option for childcare. Countries with well-developed welfare states, with supportive policies, tend to have higher employment rates, although with more part-time employment (Hofferth & Collins, 2000; Mandel & Semyonov, 2006). Broader cultural norms regarding acceptance of mothers working full-time is associated with smaller gaps in maternal employment probabilities and working hours (Del Boca et al., 2009; Boeckmann et al., 2015), helping to reduce work-family conflict. These findings suggest that both cultural and institutional factors need to be considered when examining employment patterns (Boeckmann et al., 2015).

Household dynamics, access to informal support networks, and attitudes towards parenthood are all intricately linked to an individual's employment status. A woman's decision to work can be based on joint economic decisions with her partner, considering their human capital and gender pay differentials (Boeckmann et al., 2015), if one partner earns more, it can reduce financial pressure and the need for the other partner to work (Abroms and Goldscheider 2002; Powell 2002; Verbakel & de Graaf 2009). Dual-earner couples often have less time for household activities, including childcare. Childcare significantly influences employment status, particularly for mothers, because they are usually considered as the primary care providers for their children, which can sometimes lead women to leave the labor force, especially with small children (Arpino & Luppi, 2020). Conversely, according to Thil et al. (2023) study shows that as mothers become more involved in the workforce and if the partner is also working, households increasingly demand both formal and informal care. Furthermore, factors like the mother's age and education level influence demand for childcare, with older mothers using more childcare of both types and highly educated mothers using more formal care (Thil et al., 2023). The partner's employment status is also crucial in fertility decisions, possibly intensifying or relieving the impact of an individual's unemployment on starting a family. For instance, Inanc

(2015) found that in married couples, the timing of parenthood can be largely determined by the female partner's labor market status, therefore, if the woman is employed, they are significantly less likely to become parents. Joint employment statuses within a couple significantly affect the likelihood of transitioning to parenthood, with patterns differing between married and cohabiting couples. For example, in Britain, Inanc (2015) in his paper identified that unemployment is linked to earlier parenthood, but the effect depends on relationship status and the partner's employment. He also found that while cohabiting men and single women are more likely to have children when unemployed, married couples follow traditional economic models where male unemployment delays parenthood and female unemployment increases it. However, for cohabiting couples, unemployment in either partner leads to earlier childbirth, which is contrary to neoclassical expectations. Traditional household models often assume the male partner as the primary income provider and women as primary caregiver (Kaufman & Bernhardt, 2014).

While not explicitly detailed in terms of satisfaction levels, the sources indicate that women, even in full-time employment, often bear the main responsibility for domestic responsibilities, leading to a "double burden" rather than the equal division of work within the household (León, 2005). León (2005) emphasizes that the division of domestic labor and caring tasks between partners is a crucial aspect related to balancing work and family life. The impact of a partner's time spent on housework can also affect an individual's satisfaction with work-family balance. The availability of informal childcare, such as that provided by grandparents, friends, relatives or babysitters, can play a role in enabling mothers to participate in the workforce. Thil et al. (2023) suggests that porous household boundaries and support from non-resident family members can be significant, however, for single mothers, the presence of grandparents in the household has been observed to negatively impact the demand for formal childcare. On the other hand, Arpino & Luppi (2020) say that informal childcare is not always available and that parents prefer formal childcare due to the quality of service provided by formal childcare centers and point out that offering formal childcare with flexible working hours and at lower costs would be an incentive for mothers to enter the labor market for full-time work. However, for single mothers, the presence of grandparents in the household has been observed to negatively impact the demand for formal childcare (Morrissey, 2017; Thil et al., 2023).

Taken together, the current literature on childcare and work-family balance on labor market participation suggests that childcare strain directly influence the incentives for mothers to work, while work-family balance policies and cultural norms determine both the practical and social feasibility of combining parenthood with employment. Perceived career trade-offs reflect the potential negative impacts of parenthood on career progression, all of which collectively impact mothers' employment status and broader labor market outcomes. Also an individual's employment status, particularly that of mothers, is not solely an individual decision but is deeply embedded within household dynamics, access to support networks, and prevailing attitudes towards parenthood and gender roles. The interplay of a partner's employment, the division of household labor, the availability of informal care, and the cultural beliefs about parental roles may direct and shape an individual's participation in the labor market.

3. Data and Methodology

The Generations and Gender Programme (GGP) represents a key social science research infrastructure that offers harmonized, large-scale, longitudinal, and cross-national panel data focused on individual life trajectories and family dynamics. Its longitudinal design facilitates

deeper insight into demographic and social transformations across different national contexts. As the successor to the Fertility and Family Survey (FFS) from the 1990s, the GGP builds on comparable micro-level data, ensuring continuity in demographic research. The initial wave (GGS-I) was launched in 2004 as a three-wave panel survey, while the second round (GGS-II), initiated in 2020, introduced updated methodological procedures and a revised baseline questionnaire. In Croatia, the GGS-II was implemented between May and July 2023, targeting individuals aged 18 to 54. The data collection, conducted through Computer-Assisted Web Interviewing (CAWI), yielded a total sample of 7487 respondents. This method enabled efficient acquisition of data across a wide array of themes, including fertility intentions, partnership dynamics, and labor market experiences.

For the purposes of this study, the analytical sample was further refined to include individuals aged 24 to 55, with students and retirees excluded. This selection ensures a focused examination of the working-age population, capturing a diverse spectrum of experiences related to labor force participation and the balance between work and family responsibilities. The exclusion criteria were employed to omit groups whose life circumstances may differ substantially, thereby allowing for a more precise analysis of the challenges faced by individuals actively engaged in the workforce. The GGP Round II – Wave 1 dataset thus contributes meaningfully to the broader GGP framework, facilitating comparative analyses of demographic behaviors and trends across countries (Čipin et al., 2024).

This study focuses on several key variables grouped into thematic categories relevant to employment status, childcare dynamics, work–life balance, and demographic controls:

a) Employment Status:

Respondents' position in the labor market is captured through information on their current employment status and engagement in work activities. These measures enable classification into employed, unemployed, or economically inactive categories, providing a basis for analyzing work-related experiences and constraints.

b) Childcare-Related Variables:

Three dimensions were used to explore childcare-related considerations. First, respondents were asked to assess how having an (additional) child might influence various aspects of their personal and professional lives. Second, the analysis considers expectations and conditions that individuals regard as necessary before deciding to have a child, such as financial security, housing, or relationship stability. Third is an assessment of respondents' satisfaction with how childcare responsibilities are shared with their partner, offering insight into perceived fairness and division of caregiving tasks.

c) Work–Life Balance:

Work–life balance is assessed through several interrelated indicators. The employment status of respondents' partners provides context for household-level economic arrangements. In addition, respondents evaluated their own ability to successfully balance work and family responsibilities. Perceptions of the distribution of household chores further contribute to understanding the division of domestic labor and its implications for overall work–life integration.

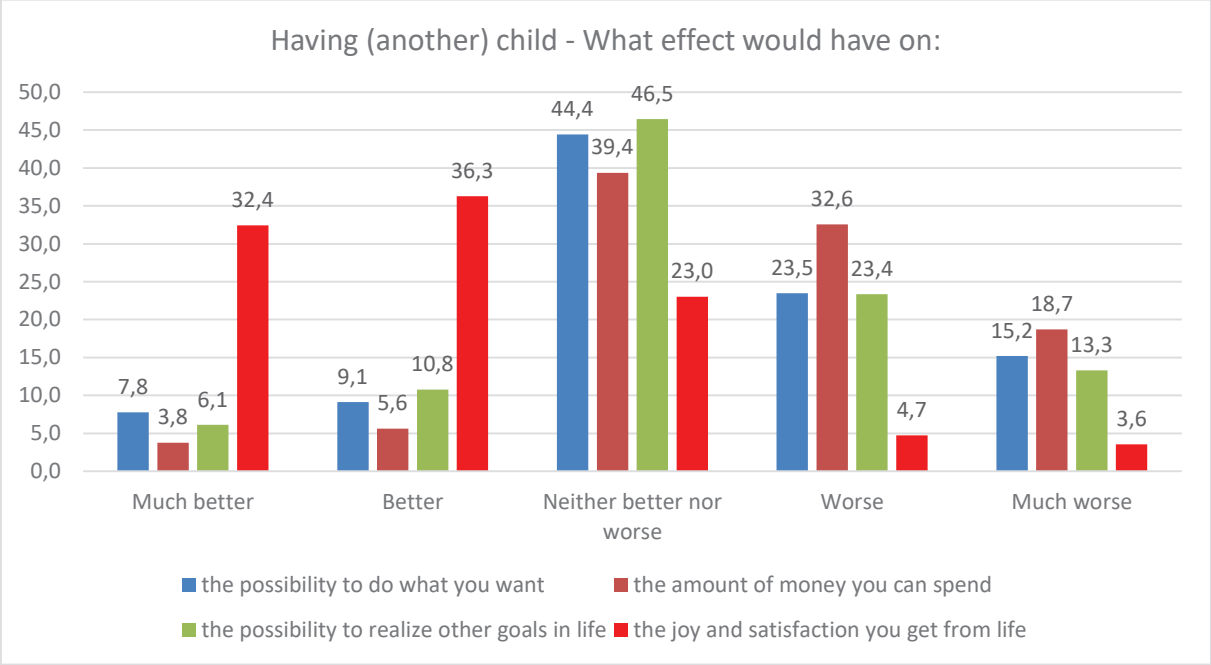
d) Control Variables:

To adjust for potential confounding factors, the analysis includes standard demographic controls: age and gender, both of which are critical for interpreting employment patterns, fertility intentions, and work–life balance.

4. Results and Discussion

We initiated the statistical analysis of the survey data by first conducting a descriptive examination of respondents' attitudes toward the potential effects of having an (additional) child on various dimensions of their personal and professional lives. Although some respondents may not have intended to expand their families, they were asked to reflect on a hypothetical scenario in which they would have a (another) child within the next three years and to assess the anticipated impact of such an event on different aspects of their lives.

Figure 1: Respondents' Perceptions of the Effects of Having (Another) Child on Personal and Financial Aspects of Life [1]



Source: Authors illustration based on survey results - GGP HR

Statistics in Figure 1. indicate a sense of ambivalence regarding parenthood. While many respondents perceive having a child as a source of emotional fulfillment (68.7%), a significant proportion express concern that it may limit their ability to achieve other personal or professional objectives. This duality highlights the importance of comprehensive work–life balance policies aimed at minimizing the perceived conflict between parenthood and the pursuit of individual aspirations. Measures such as flexible working conditions, accessible and high-quality childcare services, and effective parental leave policies can help mitigate concerns related to career disruption or time constraints. By acknowledging and addressing these mixed perceptions, policymakers can contribute to creating a social environment in which becoming a parent is not seen as incompatible with broader life goals.

[1] Survey questions: "Even if you do not plan to have a (another) child, we would still like to hear your opinion on this possibility. Imagine that you were to have a (another) child within the next three years. What impact do you think this would have on various aspects of your life: ….?"

Model 1. – Anticipating consequences of potentially having (another) child

A logistic regression analysis was conducted on 3395 individuals to examine the association between employment status and attitudes towards the consequences of having children, controlling for age and gender.

Output 1.

```
Logistic regression                               Number of obs     =      3,395
                                                  LR chi2(10)       =     126.37
                                                  Prob > chi2       =     0.0000
Log likelihood = -1501.6318                       Pseudo R2         =     0.0404
```

employed_bin	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	1.010527	.0062979	1.68	0.093	.9982583	1.022946
dem01						
Female	.457741	.0457565	-7.82	0.000	.3762984	.5568102
fer25b_3cat						
Neutral	1.530272	.248036	2.62	0.009	1.113783	2.102503
Worse	2.249807	.3759019	4.85	0.000	1.62153	3.121516
fer26i_3cat						
Unsure	.8494081	.1280983	-1.08	0.279	.6320445	1.141524
Yes	1.053825	.1533037	0.36	0.719	.792394	1.401509
fer26h_3cat						
Unsure	1.348374	.2091544	1.93	0.054	.994891	1.82745
Yes	1.31447	.1958532	1.84	0.066	.9815745	1.760264
fer26f_3cat						
Unsure	1.116828	.1567188	0.79	0.431	.8482843	1.470385
Yes	1.646118	.2306131	3.56	0.000	1.250869	2.166258
_cons	1.733952	.5724585	1.67	0.095	.9078534	3.311757

Note: _cons estimates baseline odds.

Predictors:

- Financial Impact of Children (fer25b_3cat): Compared to individuals anticipating a *better* financial situation after having a child, those anticipating a *neutral* impact (OR = 1.53, p = 0.009) or a *worse* impact (OR = 2.25, p < 0.001) had significantly higher odds of being employed.
- Work-Family Balance (fer26f_3cat): Individuals who believed they *could* balance work and family life had significantly higher odds of being employed compared to those who believed they could not (OR = 1.65, p < 0.001). Being "Unsure" was not significantly different from "No" (p = 0.431).
- Childcare Access (fer26h_3cat): Perceived access to satisfactory childcare showed a positive but only marginally significant association with employment. Compared to expecting *no* access, being "Unsure" (OR = 1.35, p = 0.054) or expecting access ("Yes") (OR = 1.31, p = 0.066) was associated with higher odds of employment, but these failed to reach statistical significance at the conventional α=0.05 level.
- Parental Leave Access (fer26i_3cat): No significant association was found between perceived access to sufficient parental leave ("Unsure" or "Yes" vs. "No") and employment status (p > 0.10 for both).

Anticipating a neutral or negative financial impact from having children is associated with higher odds of being employed. One possible explanation is that employed individuals may have a more realistic understanding of the financial demands of raising children, whereas those expecting financial benefits might be less engaged with the labor market for other reasons. Likewise, confidence in one's ability to balance work and family life shows a strong association with employment status. This association may stem from a combination of factors, including access to greater resources among the employed, the development of effective coping mechanisms, or personality traits that simultaneously support employment success and foster a strong sense of self-efficacy.

After including control variables, the link between perceived access to childcare and employment weakened, becoming only marginally significant, while perceived access to parental leave showed no significant association. This might imply that the influence of these expected supports is less direct than initially thought, potentially overlapping significantly with demographic factors like gender, or simply less critical than financial outlooks and general work-life balance confidence in this specific context. Of course, the specific policies and cultural norms around parental leave and childcare within the relevant population, possibly Croatia, could also play a role here.

However, the model accounts for only a small proportion of the variation in employment (Pseudo $R^2 \approx 4\%$), which represents a key limitation. This indicates that employment status is shaped by many additional factors. Including further control variables—such as education level, marital status, and the presence and age of children—would be essential for providing a more comprehensive and accurate understanding of the determinants of employment.
Furthermore, it's vital to remember this cross-sectional analysis identifies associations, not cause-and-effect relationships. In essence, the findings suggest that beyond demographics, individuals' subjective views on the financial consequences of children and their perceived ability to manage work-life integration are significantly linked to their employment. In contrast, the perceived availability of formal supports like parental leave and childcare showed weaker connections within this particular model.

Model 2. - Employment Determinants in a Partnered Sample: Household and Support Factors

The second model includes a smaller number of observations (1710) compared to the previous one, as the analysis is now limited to a subsample consisting only of respondents who have partners. This restriction was necessary due to the inclusion of partner-related variables. Therefore, the interpretation of the results applies specifically to this subsample.

Output 2.

```
Logistic regression                               Number of obs     =      1,710
                                                  LR chi2(6)        =     214.67
                                                  Prob > chi2       =     0.0000
Log likelihood =  -749.7354                       Pseudo R2         =     0.1252
```

employed_bin	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	1.083277	.01166	7.43	0.000	1.060663	1.106373
dem01						
Female	.1983495	.0344509	-9.31	0.000	.1411197	.2787883
partner_employed_bin						
Employed	3.43913	.6640732	6.40	0.000	2.355522	5.021228
hhd12	.9405287	.0376031	-1.53	0.125	.8696417	1.017194
hhd14	1.068207	.0451084	1.56	0.118	.9833558	1.160379
hhd18						
No	.6799489	.0909176	-2.88	0.004	.5231907	.8836749
_cons	.1933159	.1078781	-2.94	0.003	.0647534	.5771287

Note: _cons estimates baseline odds.

The model 2 is statistically significant overall (LR $\chi^2(6) = 214.67$, $p < 0.001$) and explains a considerably larger portion of the variance compared to previous models (Pseudo $R^2 = 0.125$, or 12.5%). This improvement is likely due to the inclusion of strong predictors like partner's employment status and the focus on a potentially more homogenous subsample.

Predictors:

- Partner's Employment (partner_employed_bin - Employed): Having an employed partner is strongly associated with higher odds of the respondent being employed. Respondents whose partner is employed have 3.44 times the odds of being employed themselves compared to those whose partner is not employed (OR = 3.439, $p < 0.001$).
- Satisfaction with Household Task Sharing (hhd12): Satisfaction with the division of household tasks showed no statistically significant association with employment status (OR = 0.941, $p = 0.125$).
- Satisfaction with Childcare Task Sharing (hhd14): Similarly, satisfaction with the division of childcare tasks showed no statistically significant association with employment status (OR = 1.068, $p = 0.118$).
- Informal Childcare Help (hhd18): Receiving regular childcare help from relatives or friends is significantly associated with employment. Respondents who do *not* receive this help have 32% lower odds (OR = 0.680, $p = 0.004$) of being employed compared to those who *do* receive such help.

Focusing specifically on individuals with partners, this analysis identifies several strong predictors of employment. A partner's own job status stands out as particularly influential, highlighting how interconnected work life is within couples – a connection likely stemming from shared finances, lifestyle choices, or the tendency for people to partner with similar others. Consistent with broader demographic trends, age and gender remain significant factors. Older individuals are generally more likely to be employed, while women within this partnered group

face lower odds, and this gender disparity seems particularly pronounced here. Access to informal childcare help also proves critically important. Having support from family or friends clearly makes holding a job easier, especially when balancing work and family responsibilities. Consequently, individuals lacking this informal support network face significantly lower odds of being employed. Satisfaction with how household chores or childcare are divided doesn't directly predict employment status in this analysis. While potentially affecting relationship quality or well-being, satisfaction levels with these internal dynamics seem less critical for the simple outcome of having a job compared to factors like a partner's employment or the availability of external support.

Overall, this set of variables explains a reasonable portion (Pseudo R^2 = 12.5%) of the employment variation within this specific group of partnered individuals. It remains crucial to recognize that these findings apply only to this subsample and cannot be generalized to the wider population without further understanding the reasons for the sample reduction.

5. Conclusion

This paper explores the factors linked to employment status using The Generations and Gender Programme (GGP) Round II (Wave 1) dataset, with a focus on household dynamics, informal support, and individual attitudes. The results show a clear positive connection between having an employed partner and being employed oneself. On the other hand, not receiving regular informal childcare support from relatives or friends was linked to a lower likelihood of employment. Standard demographic trends were also confirmed—older individuals were more likely to be employed, while women had lower employment rates compared to men. Confidence in managing both work and family responsibilities was positively related to employment status, as was the expectation that having children would not lead to a better financial situation.

However, several limitations should be considered. The analysis is based on cross-sectional data, meaning that it identifies associations but cannot determine cause-and-effect relationships. The initial models used in the paper explained a small portion of the variation in employment status, pointing to the presence of other influencing factors. A second model focused specifically on individuals in partnerships and showed better explanatory power, but the findings apply only to that subgroup and should not be generalized without further research. In addition, the analysis mainly relied on subjective assessments and attitudes, and some key objective factors—such as education level or detailed information about children—were not included in all parts of the analysis.

These findings suggest several directions for future research, especially relevant in the Croatian context. Longitudinal studies would be helpful to understand how household situations, support systems, and personal attitudes affect employment decisions over time. Future research that incorporates a broader set of variables—such as education, income, and more nuanced family characteristics—has the potential to offer a more comprehensive understanding of the factors influencing employment outcomes. It would also be useful to look more closely at why perceived access to formal support like parental leave and childcare seems to have less influence on employment in this context. Comparing these results with data from other countries could offer further insights.

The results also have policy implications for improving work-family balance and increasing participation in the labor market in Croatia and similar countries. The strong influence of a partner's employment and the role of informal childcare highlights how family members' economic activities are connected and how much people rely on informal support. Policymakers should take these relationships into account and think about how formal services and informal networks work together. Reducing gender disparities in employment and advancing policies

that support individuals—particularly women—in balancing work and family responsibilities, such as flexible working arrangements and accessible childcare, remain critical. Equally important is addressing concerns related to the financial and practical challenges of parenthood, thereby enabling individuals to pursue both family life and career development simultaneously.

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The authors acknowledge the use of large language models (LLMs) during the preparation of this paper. These tools were employed to assist in organizing and synthesizing relevant literature, refine academic language, and improve overall clarity and coherence of the text. The final responsibility for the content, analysis, and conclusions drawn in this paper rests solely with the authors.

REFERENCES

Abroms, L.C., Goldscheider, F.K. (2002): ***More Work for Mother: How Spouses, Cohabiting Partners and Relatives Affect the Hours Mothers Work***. Journal of Family and Economic Issues 23, 147–166. https://doi.org/10.1023/A:1015786600645

Arpino, B., & Luppi, F. (2020): ***Childcare arrangements and working mothers' satisfaction with work–family balance***. Demographic Research, 42, 549–588. https://www.jstor.org/stable/26936799

Bauernschuster, S. & Schlotter, M. (2015): ***Public child care and mothers' labor supply—Evidence from two quasi-experiments***, Journal of Public Economics, 123, 1-16. https://doi.org/10.1016/j.jpubeco.2014.12.013

Becker, G. S. (1965): ***A theory of the allocation of time***. The Economic Journal, 75(299), 493–517. https://doi.org/10.2307/2228949

Blau, D. M., & Robins, P. K. (1988): ***Child-care costs and family labor supply***. The Review of Economics and Statistics, 70(3), 374-381. https://doi.org/10.2307/1926774

Blau, D.M. & Robins, P.K. (1989): ***Fertility, Employment, and Child-Care Costs***. Demography, 26, 287–299. https://doi.org/10.2307/2061526

Blau, F. D., & Kahn, L. M. (2007): ***Changes in the labor supply behavior of married women: 1980–2000***. Journal of Labor Economics, 25(3), 393–438. https://doi.org/10.1086/513416

Boeckmann, I., Misra, J., & Budig, M. J. (2015): ***Cultural and Institutional Factors Shaping Mothers' Employment and Working Hours in Postindustrial Countries***. Social Forces, 93(4), 1301–1333. http://www.jstor.org/stable/24754189

Cascio E.U. (2009): ***Maternal Labor Supply and the Introduction of Kindergartens into American Public Schools***, Journal of Human Resources, 44(1), 140-170. https://doi.org/10.3368/jhr.44.1.140

Connelly, R. (1992): ***The Effect of Child Care Costs on Married Women's Labor Force Participation.*** The Review of Economics and Statistics, 74(1), 83–90. https://doi.org/10.2307/2109545

Čipin, I., Međimurec, P., Mustač, D., Smolić, Š., & Fabijančić, M. (2024): ***Generations and Gender Survey Croatia, Round 2–Wave 1: Data Collection Process***.

Del Boca, D., Pasqua, S., & Pronzato, C. (2009): ***Motherhood and market work decisions in institutional context: a European perspective,*** Oxford Economic Papers, 61, 147–171. https://doi.org/10.1093/oep/gpn046

Givord, P. & Marbot C. (2015): ***Does the cost of child care affect female labor market participation? An evaluation of a French reform of childcare subsidies***, Labour Economics, 36, 99-111. https://doi.org/10.1016/j.labeco.2015.07.003

Hofferth, S. & Collins, N. (2000): ***Child care and employment turnover***. Population Research and Policy Review 19, 357–395. https://doi.org/10.1023/A:1026575709022

Inanc, H. (2015): ***Unemployment and the timing of parenthood: Implications of partnership status and partner's employment.*** Demographic Research, 32, 219–250. http://www.jstor.org/stable/26350113

Kaufman, G., & Bernhardt, E. (2014): ***Gender, work and childbearing: couple analysis of work adjustments after the transition to parenthood***. Community, Work & Family, 18(1), 1–18. https://doi.org/10.1080/13668803.2014.928610

Kimmel, J. (1998): ***Child Care Costs as a Barrier to Employment for Single and Married Mothers.*** The Review of Economics and Statistics, 80(2), 287–299. http://www.jstor.org/stable/2646639

León, M. (2005): ***Welfare State Regimes and the Social Organization of Labour: Childcare Arrangements and the Work/Family Balance Dilemma***. The Sociological Review, 53(2), 204-218. https://doi.org/10.1111/j.1467-954X.2005.00581.x

Mandel, H., & Semyonov, M. (2006): ***A Welfare State Paradox: State Interventions and Women's Employment Opportunities in 22 Countries***. American Journal of Sociology, 111(6), 1910–1949. https://doi.org/10.1086/499912

Morrissey, T. W. (2017): ***Child care and parent labor force participation: a review of the research literature.*** Review of Economics of the Household, 15(1), 1-24. https://doi.org/10.1007/s11150-016-9331-3

Powell, L. M. (2002): ***Joint Labor Supply and Childcare Choice Decisions of Married Mothers***. The Journal of Human Resources, 37(1), 106–128. https://doi.org/10.2307/3069605

Schwartz, C. R., & Mare, R. D. (2012): ***Trends in assortative mating from 1940 to 2009***. Demography, 49(2), 621–646.

Thévenon, O. (2011): ***Family Policies in OECD Countries: A Comparative Analysis***. Population and Development Review, 37(1), 57-87. https://doi.org/10.1111/j.1728-4457.2011.00390.x

Thil, L., Lawson, L.A. & Lefebvre, M. (2023): ***An Empirical Assessment of the Drivers of Formal and Informal Childcare Demand in European Countries***. Social Indicators Research, 170, 581–608. https://doi.org/10.1007/s11205-023-03198-3

Verbakel, E., & de Graaf, P. M. (2009): ***Partner effects on labour market participation and job level: opposing mechanisms.*** Work, Employment and Society, 23(4), 635-654. https://doi.org/10.1177/0950017009344909

A scientific paper

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BETWEEN REASON AND IMPULSE: PRICING STRATEGIES AND CROATIAN CONSUMERS

ABSTRACT

The high competitiveness of the retail environment forces manufacturers and vendors to constantly try to draw attention to their products. This is especially true in the current climate of global uncertainty, growing economic pessimism and new technologies influencing consumer behaviour. Consumers make numerous decisions every day that are influenced not only by their preferences but also by emotional and cognitive factors. Therefore, psychological pricing is becoming an increasingly important strategy. This paper examines how Croatian consumers perceive and react to various forms of psychological pricing, including prices with the final digit 9 (referred to as "charm prices"), the anchoring effect, the lure effect, and other methods. Their preferences for key product attributes, such as quality, price, brand design, and others, are also analysed. The research was conducted with a sample of 456 respondents using an online questionnaire, and the data were analysed using Mann-Whitney U and Kruskal-Wallis H tests. The results show that while most respondents describe themselves as rational and responsible shoppers who plan their purchases, they still tend to engage in impulse buying, especially in situations involving special offers. Men find prices ending in a 9 more attractive and cheaper than women, and are more likely to round them up to a lower number. Older age groups and less educated respondents show a greater sensitivity to psychological prices, while younger respondents place more value on product design and brand. In summary, although rational behaviour is the ideal of most consumers, emotional and heuristic influences have a significant impact on their decisions. The results can help companies to optimise their pricing strategies, taking into account demographic differences among customers, especially in the context of market changes and increasing pressure on household budgets.

Key words: *Psychological pricing, Consumer behaviour, Charm prices, Impulse buying.*

1. Introduction

Historically, the beginnings of industrialisation were characterised by companies' efforts to meet market demand with a sufficient quantity of products. In the intervening period, economic trends have reversed, so that today, in almost all markets encountered by consumers, demand is significantly higher than supply. As a result, manufacturers seek to achieve customer

recognition of their products through their operational and marketing strategies. In the dynamic environment of modern retailing, the pricing of products and services is not losing its importance. In addition to traditional approaches to pricing, psychological pricing has garnered increasing attention from retail experts, economists, and decision theorists over the past few decades. The basis of this idea is the assumption, which has been thoroughly examined in psychology, that consumers, although they consider themselves rational, do not make their decisions exclusively rationally, but that their perceptions of value, quality and price acceptance are significantly influenced by heuristics, emotional reactions and cognitive biases (Monroe, 2003; Nagle & Müller, 2018).

One of the best-known and most common forms of psychological pricing is the use of so-called charm prices – prices ending in the number 9, such as 1.99 or 9.99 – which are perceived by consumers as significantly lower than their rounded equivalents (Thomas & Morwitz, 2005). Such prices are used to create the impression of a bargain and encourage impulsive purchases, especially for consumer goods. Psychological mechanisms that explain this phenomenon include the left-hand-side effect, mental rounding and the reference frame effect (Bizer & Schindler, 2005; Melnik & Alm, 2005). In contrast, in specific contexts, such as luxury or status goods, consumers value rounded or higher prices because they perceive them as an indicator of quality and prestige (Stiving & Winer, 1997; Lichtenstein et al., 1993).

Psychological pricing strategies include a range of additional approaches. The anchoring effect, for example, relies on the fact that the first price one sees forms a mental benchmark, which then unconsciously influences the assessment of the value of all other options (Tversky & Kahneman, 1974). The trade-off effect and the decoy effect also illustrate how the presence of additional (sometimes deliberately inferior) options can change consumers' preferences among existing alternatives (Huber, Payne & Puto, 1982; Ariely, 2008). Product grouping and bundling are other ways to manipulate value perception, where the combination of products or services creates the impression of a better offer or greater benefit for the same price (Yadav & Monroe, 1993). Despite the widespread use of these strategies in retail practice, there remains no clear consensus in the scientific literature regarding their actual effectiveness. Another challenge is that most empirical research originates from the context of developed Western markets, while data from the Central European and Mediterranean regions, including Croatia, are relatively scarce. The retail environment in Croatia, characterised by intense price competition, high consumer price sensitivity, and the increasing digitisation of the shopping process, provides a particularly interesting setting for analysing the effectiveness of psychological strategies.

This paper aims to contribute to the understanding of psychological pricing by summarising the relevant literature and conducting an empirical study on the perception of these strategies by consumers in the Republic of Croatia. By analysing the effects of the most common psychological approaches – including charm pricing, anchoring effect, bait effect, prestige pricing and mixed packaging – the aim is to determine the extent to which Croatian consumers react to psychological pricing and how their behaviour differs compared to theoretical assumptions and foreign examples. The research findings will provide additional insights into which strategies are most effective in the Croatian context, while also highlighting possible differences in perceptions among different demographic and socio-economic groups. In this way, our work not only enriches the existing scientific literature but also offers practical recommendations for the business sector on price optimisation in times of technological disruption and innovations that we can assume have influenced consumer preferences and purchasing habits.

2. Literature review

A systematic study on impulse buying (Redine et al., 2022) has shown that impulse buying plays an important and increasing role in global retail. Psychological attempts to persuade consumers to make a purchase are therefore not a thing of the past. These efforts, including but not limited to price decisions, are becoming increasingly important. In their study on the determinants of impulsive buying behaviour, Lopes, Amaro and Henriques (2023) found that women differ in whether they shop alone or in company, while men seem to be insensitive to these differences, as well as to differences in age, education and income, while for women all the aforementioned demographic characteristics lead to differences. Their conclusions follow research published in the same year (Filipas, Vretenar & Prudky, 2023), which found that a significantly larger number of factors play a role in women. Thomas, Louise and Vipinkumar (2018) emphasise the influence of the visual presentation of goods on consumer behaviour in relation to impulse purchases, interpreting the visual presentation as a "silent salesperson" that draws consumers into the shop and influences their purchasing decisions. Recent research (Florea et al., 2024) comes to similar conclusions, emphasising the importance of supporting visuals that encourage impulsive purchases, as did Nambiar (2025). However, she found no significant differences based on shoppers' demographics. A study conducted by Sundström, Hjelm-Lidholm and Radon (2019) has shown that boredom is an incentive for online impulse purchases, with price, availability and free shipping among the most important triggers for purchase.

Interesting research on the old psychological idea that prices ending in .99 are more appealing was provided by Gaston-Breton (2011), who found that consumers who are more price-sensitive and less committed to analysing purchases are more likely to buy products priced in this way. The novelty of their analysis is that younger, less educated and lower-income consumers are more likely to make such choices. Wadhwa and Zhang (2015) point out that the perception of the valuation of a purchased product with a prominent rounded or unrounded price differs depending on the purchase motive. For example, in emotionally motivated purchases, consumers tend to evaluate the performance of the product better when it is purchased at a rounded price, while in rational purchases for business purposes, they tend to evaluate products better when they are purchased at an unrounded price. Numerous studies confirm that psychological pricing can increase consumption, but at the same time emphasise that the results depend significantly on the context – the type of product, the consumer profile, the cultural environment and the level of information (Grewal et al., 1998; Zhang & Monroe, 2011). It is particularly important to emphasise that the same strategies can have a different effect in different product categories (hedonic vs. utilitarian) or for consumers, as they necessarily do not trigger the same emotions (Bettiga, 2020). Research by Ortega and Tabares (2023) shows that consumers respond positively to unrounded prices (.99 and similar) for most brands, but that this is not the case when it comes to products they perceive as luxurious. For such products, a higher price is associated with higher quality, so that rounded prices have a better effect than unrounded prices.

Recent research (Bujisic et al., 2024) on the use of lures in offer design shows interesting results: When consumers are offered a basic product and an enriched basic product, most customers opt for the cheaper basic product. However, if an intermediate alternative is provided, which has the same price as the enriched product but is slightly inferior in terms of content, most customers opt for the enriched product. The middle alternative is therefore a successful lure to increase the attractiveness of the enriched offer. In addition, the results in attracting customers to the enriched offer are even better if the prices of its components are displayed,

which shows that the total price is more favourable. Consumer reactions to the anchor effect show that consumers do judge price influenced by anchors (Zong & Guo, 2022). Their decisions differ according to gender, personality type, expertise and skills, self-confidence and other factors. External anchors can be, for example, the prices of competing products, while internal anchors are based on creating a more pleasant shopping environment, such as satisfaction with service, and the like.

3. Methodology, sample and data

The empirical research was conducted in Croatia from May to October 2024 using an online Google Forms questionnaire to collect the appropriate data. A total of 456 respondents filled out the questionnaire, providing valid responses and forming the sample for the research. Several social networks were used to distribute the online Google Forms questionnaire to reach a diverse respondent group, thus achieving the size and, later on, the aimed structure of the sample. The questionnaire included questions designed to examine respondents' shopping habits and decision-making processes. The demographic characteristics of the respondents are presented in Table 1, which illustrates the diversity of the sample. Approximately two-thirds of the respondents were women, and 60.1 % of the respondents were under 40 years of age. The respondents represent a range of educational levels, with the largest subgroups being those who have completed high school, followed by individuals holding a university master's degree. In terms of employment status, the majority of respondents (62.9 %) are employed, followed by pupils and students (26.1 %), the unemployed (6.1 %), and retirees (4.8 %).

Table 1: Demographic characteristics of respondents

Category	Item	Frequency	Share (%)
Gender	Male	146	32.0
	Female	310	68.0
Age group	<25 years	143	31.4
	26-39 years	131	28.7
	40-55 years	130	28.5
	56-69 years	35	7.7
	70+ years	17	3.7
Education level	Lower education	18	3.9
	High school education	160	35.1
	Bachelor education	101	22.1
	University master education	143	31.4
	PhD or…	34	7.5
Work status	Unemployed	28	6.1
	Pupil/student	119	26.1
	Employed	287	62.9
	Retired	22	4.8

Source: Authors

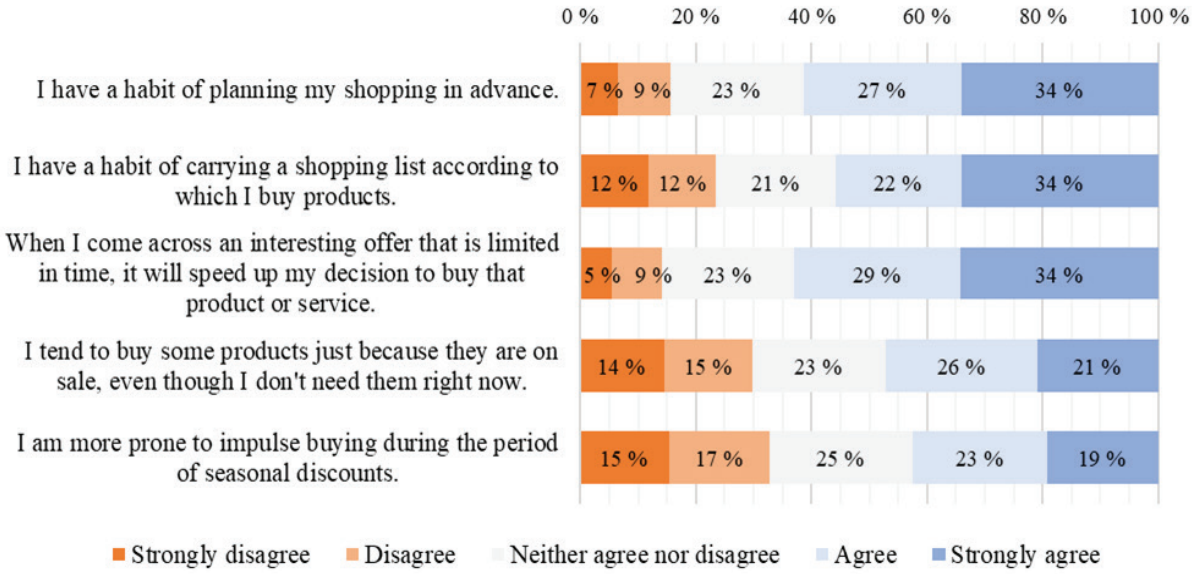
Through empirical research, we searched for insights into consumer behaviour during the shopping process. We aimed to investigate shopping habits, impulse buying tendencies, and the perceived significance of various product attributes, including price, brand, and quality. Specifically, this study analyses consumer behaviour in terms of purchase planning vs. impulsiveness, post-purchase regret, reaction to limited offers and reaction to .99 prices. The objective of the survey was to explore the factors that influence purchasing decisions and

evaluate how consumers prioritise and assess product features when making a purchase. Using IBM SPSS Statistics 21, we conducted Mann-Whitney U and Kruskal-Wallis H pairwise comparison tests to determine if there were statistically significant differences among certain demographic groups of respondents.

4. Results

An analysis of the respondents' purchasing habits (Figure 1) reveals a profile of responsible shoppers. Notably, 61.4 % of participants plan their purchases, and over half (55.9 %) report carrying a shopping list. However, time-sensitive promotions influence their buying decisions: 47.1 % of respondents acknowledge that they would purchase a discounted item even if it is not a necessity. Additionally, 42.5 % admit to being susceptible to impulsive buying during seasonal sales, while 32.7 % claim to be unaffected by such influence.

Figure 1: Consumer shopping habits and impulse buying tendencies



Source: Authors

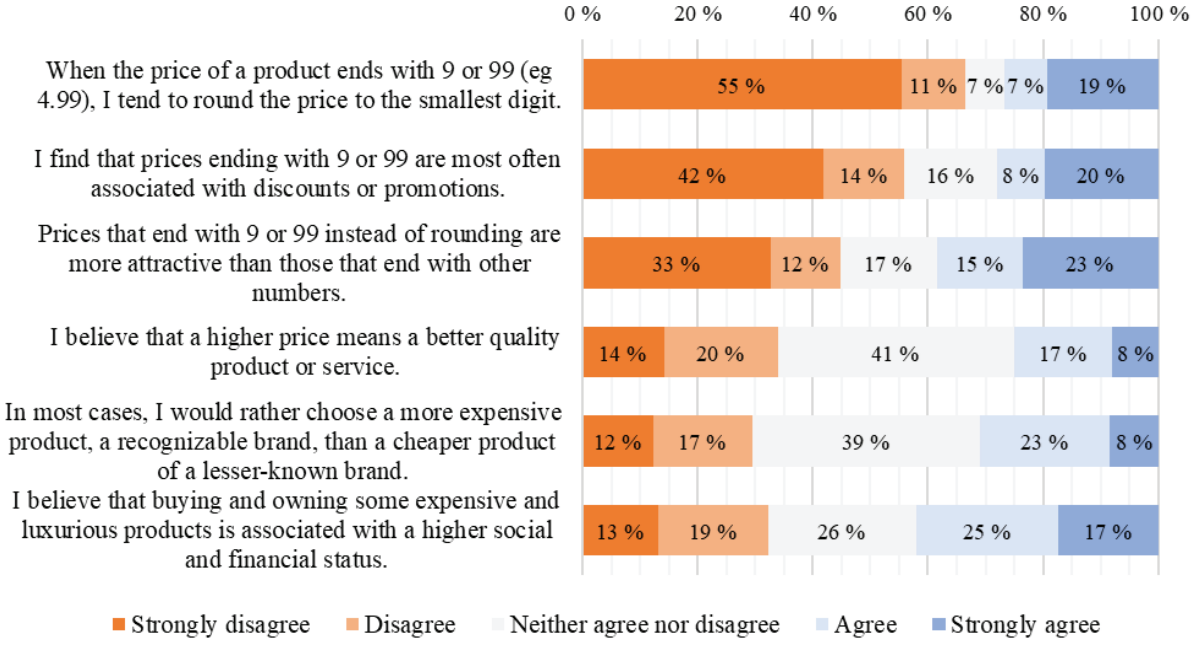
A comparison of the respondents' responses, categorised by gender, age group, and level of education, was conducted to identify differences in the behaviour of specific groups of buyers. In conducting Mann-Whitney U tests, we discovered statistically significant differences in the responses of women and men regarding their shopping behaviours. Notably, there is a significant difference in purchase planning ($z = -3.129$, $p = 0.002$), with men reporting a higher frequency of purchase planning ($M = 3.92$) compared to women ($M = 3.64$). Additionally, a significant difference was identified in behaviour towards limited-time offers ($z = -3.635$, $p = 0.000$), where men tend to make purchasing decisions much sooner ($M = 4.03$) than women ($M = 3.65$). Another significant finding relates to purchasing products on sale ($z = -5.272$, $p = 0.000$); men are more likely to buy items on sale, even if they do not require them ($M = 3.68$), whereas women have a lower mean ($M = 3.03$). Finally, a significant difference was also noted in shopping behaviour during seasonal downturns ($z = -2.217$, $p = 0.027$), with men ($M = 3.34$) more likely to engage in impulse purchases than women ($M = 3.05$).

We conducted Kruskal-Wallis H tests to investigate statistically significant differences in responses from various age groups. In terms of the habit of planning shopping ($\chi2(4) = 16.506$, $p = 0.002$), our findings revealed that respondents aged under 25 (M = 3.49) engaged in this practice the least, while those in the 56-69 age group exhibited the highest tendency to plan (M = 4.23). A similar trend was observed with the use of shopping lists ($\chi2(4) = 31.162$, $p = 0.000$); again, the youngest respondents under 25 (M = 3.03) reported using lists the least, whereas individuals in all other age brackets did so more frequently (26-39: M = 3.69; 40-55: M = 3.71; 56-69: M = 4.25; 70+: M = 4.00). Lastly, when asked whether they purchase items solely because they are on sale ($\chi2(4) = 16.147$, $p = 0.003$), respondents aged 56-69 (M = 3.97) indicated that they did so more often than any of the younger age groups (under 25: M = 3.24; 26-39: M = 3.04; 40-55: M = 3.20).

We also examined how shopping habits differ among respondents with varying levels of educational attainment. Utilising the Kruskal-Wallis H tests, we identified significant differences in several areas: the planning of shopping activities ($\chi2(4) = 11.865$, $p = 0.018$), the tendency to carry a shopping list ($\chi2(4) = 11.865$, $p = 0.018$), and shopping behaviours influenced by time-restricted offers ($\chi2(4) = 11.865$, $p = 0.018$). Respondents with a high school diploma exhibited the least planning (M = 3.49) in their shopping activities, whereas those who attained a PhD demonstrated the highest level of planning (M = 4.18). A similar trend was observed regarding the habit of carrying a shopping list: high school diploma holders were the least likely to carry a list (M = 3.16), while PhD respondents were the most likely to do so (M = 4.23). Additionally, when it came to reacting to time-limited offers, bachelor's degree holders (M = 3.89) responded the quickest, while those with only a high school diploma (M = 3.49) felt the least pressure in making decisions.

The respondents' attitudes toward pricing strategies and brand prestige (Figure 2) continue to reveal a sense of responsibility in their purchasing decisions. When asked about rounding down product prices if they end with the number 9 (e.g., 4.99), 66.4 % of them answered negatively. However, over a quarter (26.8 %) admitted to doing so. Similarly, 55.9 % of the respondents do not perceive prices ending in the number 9 (e.g. 4.99) as sales or discounts, but again, more than a quarter of the respondents (28.1 %) perceive such prices as discounted. A notable share of respondents (38.4 %) find prices ending in 9 (e.g., 4.99) more appealing than rounded prices (e.g., 5.00). Regarding the relationship between price and product quality, the largest segment of respondents remains undecided (41.0 %). However, slightly more individuals believe that a higher price does not necessarily indicate higher quality (34.0 %) compared to those who do associate a higher price with superior quality (25.0 %). Additionally, 29.6 % of respondents prefer to purchase a more expensive product from a recognised brand, while 30.9 % would choose a cheaper offering from a lesser-known manufacturer if given the option. Regarding the purchase and ownership of expensive and luxury items, the respondents' perspectives are clearer: 32.2 % of respondents believe it is unrelated to a person's higher social and financial status. In comparison, 42.1 % of respondents believe these two things are connected.

Figure 2: Consumer perceptions of pricing, branding, and product value



Source: Authors

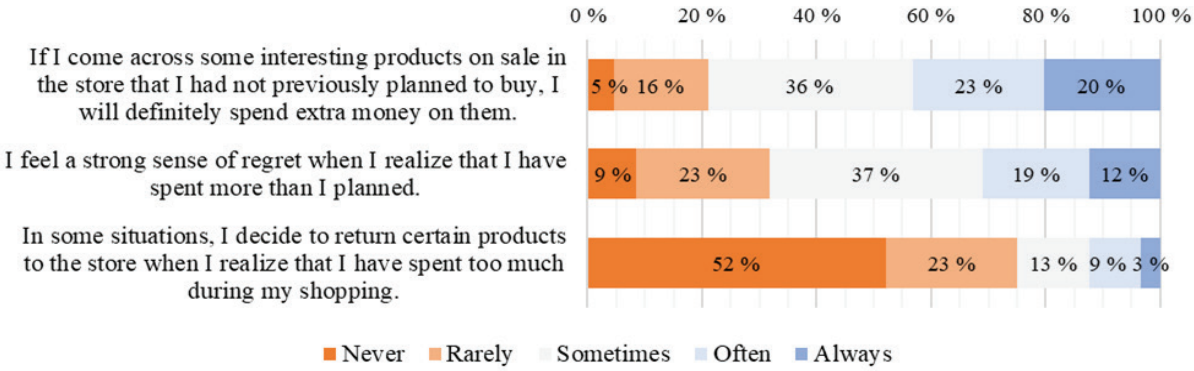
We observed statistically significant differences in the responses of women and men (using the Mann-Whitney U test) regarding all statements presented in Figure 2. Regarding product prices that end with 9 or 99, men (M = 3.12) are more likely to round down these prices compared to women (M = 1.83) (z = -7.665, p = 0.000). Additionally, men (M = 3.27) are more likely than women (M = 2.55) to associate prices ending in 9 or 99 with discounts or promotions (z = -6.521, p = 0.000). Correspondingly, prices that conclude with 9 or 99 are deemed more attractive to men (M = 3.45) than to women (M = 2.55) when contrasted with rounded prices (z = -5.675, p = 0.000). The notion that higher prices signify better quality was more strongly supported by men (M = 3.21) than by women (M = 2.68) (z = -4.637, p = 0.000). Furthermore, men (M = 3.16) expressed a greater preference for choosing a more expensive product from a recognisable brand compared to women (M = 2.88) (z = -2.644, p = 0.008). Lastly, men (M = 3.43) are more likely to associate the ownership of expensive and luxurious items with higher social and financial status than women (M = 3.00) (z = -3.279, p = 0.001).

Applying Kruskal-Wallis H tests, we identified significant differences across various age groups regarding respondents' perceptions of pricing, branding, and product value statements. The older age groups (56-69: M = 3.89; 70+: M = 3.41) demonstrated a tendency to round down the price of a product when it ended in 9 or 99 ($\chi2(4) = 42.667$, p = 0.000), unlike the younger age groups (<25: M = 2.07; 26-39: M = 1.92; 40-55: M = 2.15). Similar trends were observed in the association of prices ending in 9 or 99 with discounts or promotions ($\chi2(4) = 26.260$, p = 0.000). Respondents aged 56-69 (M = 3.74) exhibited a stronger inclination towards this association compared to younger groups (<25: M = 2.50; 26-39: M = 2.22; 40-55: M = 2.33). Notably, differences also emerged in respondents' perceptions of the attractiveness of prices ending in 9 or 99 ($\chi2(4) = 35.288$, p = 0.000). Once again, those aged 56-69 (M = 4.00) found these prices more appealing than their younger counterparts (<25: M = 3.01; 26-39: M = 2.62; 40-55: M = 2.46).

We further investigated the impact of respondents' educational achievement and identified a single instance of statistically significant differences among the observed groups. Specifically, when examining product prices, respondents with lower education levels (M = 3.61) exhibited a greater tendency to round down prices that ended in 9 or 99 ($\chi2(4) = 22.503$, $p = 0.000$), compared to the other educational categories: high school education (M = 1.99), bachelor's degree (M = 2.06), master's degree (M = 2.36), and PhD (M = 2.74).

Further findings raise questions about the previously asserted responsibility associated with shopping habits by exploring impulsive spending habits and buyer's remorse among respondents in greater detail (Figure 3). Notably, 20.2 % of respondents indicated that they would purchase an intriguing product at a discount, despite not having planned to do so, resulting in unforeseen additional spending. Furthermore, 23.0 % reported that they often engage in such behaviour, while 35.7 % stated that they do so occasionally. Conversely, only 21.1 % of respondents claimed they would rarely or never make an unplanned purchase. When individuals realise they have spent more on a purchase than initially intended, 30.9 % of respondents always or very often experience regret, with an additional 37.3 % reporting such feelings sometimes. In comparison, 31.8 % indicate that they do not regret or rarely feel it in these situations. Despite these feelings of regret over excessive spending, most respondents (75.0 %) reported that they never or seldom return purchased items. In comparison, only 12.3 % said they would definitely or likely return the products.

Figure 3: Impulsive spending and buyer's remorse among shoppers



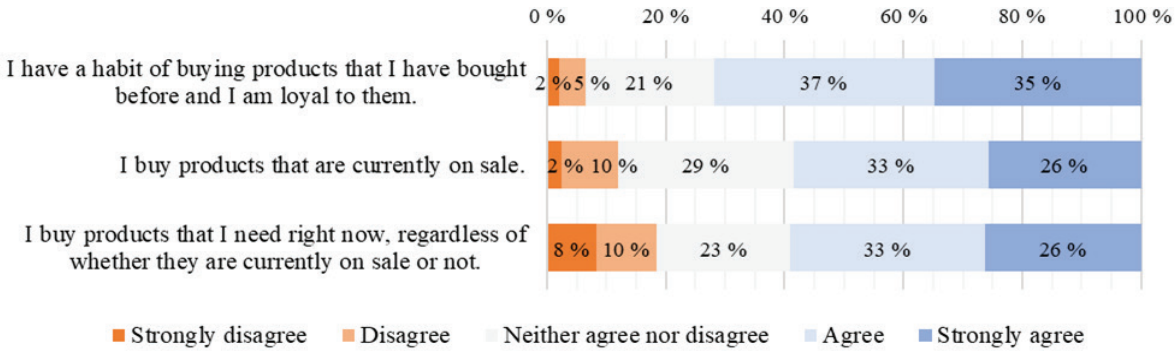
Source: Authors

In conducting Mann-Whitney U tests, we identified significant differences between men and women concerning their intent to spend more money than initially planned when encountering an interesting product ($z = -5.309$, $p = 0.000$). Men (M = 3.78) were more willing to spend the additional money than women (M = 3.19).

Applying the Kruskal-Wallis H test to evaluate impulsive spending across various age groups demonstrated significant differences in spending additional money on interesting but unplanned products ($\chi2(4) = 21.389$, $p = 0.000$). The findings indicated that respondents aged 56-69 (M = 4.14) were more inclined to make such purchases compared to those in younger age groups: under 25 (M = 3.31), 26-39 (M = 3.24), and 40-55 (M = 3.32). In contrast, comparisons among respondents with different levels of education did not bring forward any statistically significant differences.

In exploring the factors influencing purchase decisions, we aimed to discern whether these choices are driven by loyalty and habit from repeat purchases, the attraction of discounts and sales, or immediate needs and necessities (Figure 4). Our findings reveal that 71.9 % of respondents either agree or strongly agree that they tend to purchase products they have bought before and remain loyal to them, while only 6.6 % express the opposite view. Interestingly, 12.1 % of respondents stated that they do not exclusively buy products currently on sale, whereas 58.6 % indicated that they only purchase discounted items. In a somewhat contradictory trend, 59.0 % of respondents stated that they will buy products they need regardless of whether those items are on sale. Only 18.4 % said they would refrain from purchasing a necessary product if it were not on sale.

Figure 4: Factors influencing consumers' product purchase decisions



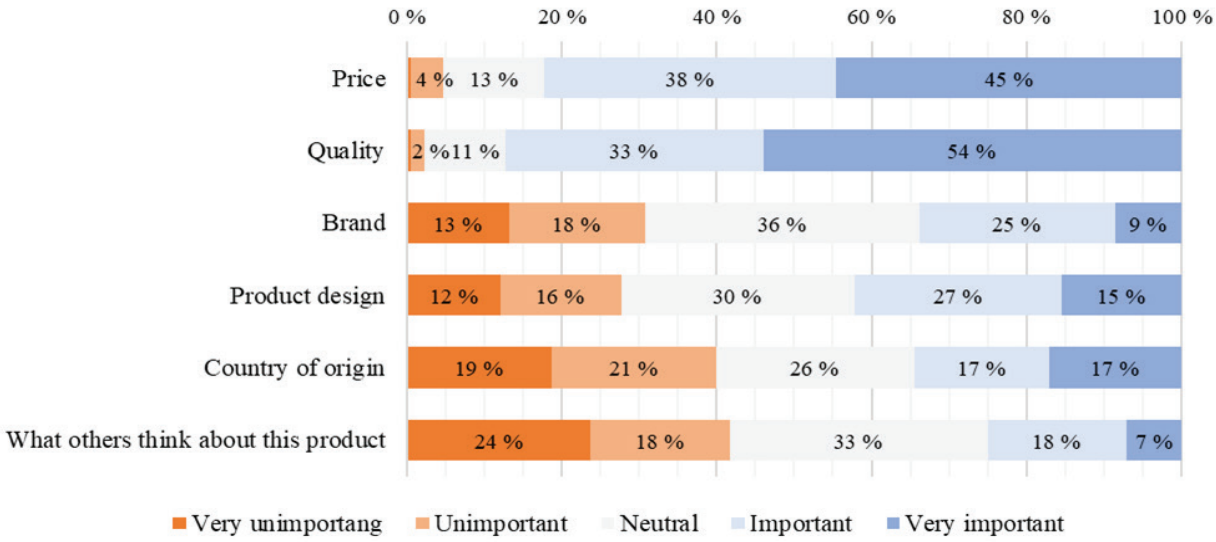
Source: Authors

Significant differences (Mann-Whitney U test) were observed between men and women in all statements presented in Figure 4. Specifically, women (M = 4.09) were more likely than men (M = 3.75) to identify themselves as loyal customers and to repurchase products they had previously purchased (z = 3.575, p = 0.000). Additionally, women (M = 3.77) demonstrated a greater tendency than men (M = 3.18) to purchase items they needed at that moment, regardless of whether those products were on sale (z = -3.852, p = 0.000). These findings are consistent with the results related to the statement on purchasing products on sale, where men (M = 3.95) reported a higher likelihood of doing so compared to women (M = 3.58) (z = 4.039, p = 0.000).

Using Kruskal-Wallis H tests, we identified significant differences among respondents from various age groups regarding their purchasing behaviours. Specifically, when asked about buying products currently on sale, we found a notable difference ($\chi2(4) = 23.299$, p = 0.000), as well as for purchasing products they currently need, irrespective of sale status ($\chi2(4) = 42.139$, p = 0.000). Respondents aged 56-69 (M = 4.29) indicated a higher likelihood of purchasing items on sale compared to younger respondents (<25: M = 3.56; 26-39: M = 3.72; 40-55: M = 3.62). Consistent with the previous findings, evaluations regarding the necessity of purchasing items at the time revealed that older age groups (56-69: M = 2.46; 70+: 2.53) expressed a lower likelihood of buying needed products unless they were on sale, in contrast to younger age groups (<25: M = 3.91; 26-39: M = 3.70; 40-55: M = 3.55). In addition, with respect to the educational attainment of the respondents, a statistically significant finding emerged: individuals with lower levels of education (M = 2.39) are less inclined to purchase necessary products when those items are not on sale ($\chi2(4) = 24.456$, p = 0.000), in contrast to respondents with higher levels of educational achievement (high school education: M = 3.57; bachelor's degree: M = 3.94; master's degree: M = 3.55; PhD: M = 3.38).

To understand the perceived importance of product attributes in consumer shopping decisions (Figure 5), we gathered evaluations from respondents regarding the significance of individual product attributes. When making a purchase, respondents prioritised the quality and price of the product most highly. Specifically, 87.3 % of respondents considered product quality to be important or very important, while 82.2 % held the same view regarding product price. 42.1 % of respondents deemed product design (very) important in their purchasing decisions, whereas 27.6 % disagreed. Opinions on product brand were varied: 30.7 % did not view the brand as (very) important, 35.5 % expressed a neutral stance on the brand's significance in their purchasing decision, and 33.8 % found the brand to be (very) important. Similarly, respondents had mixed feelings about the influence of a product's country of origin on their purchasing choices. While 34.4 % considered geographical origin to be (very) important, 39.9 % felt it did not significantly affect their decision. Lastly, the opinions of others on a product were not particularly influential for 41.7 % of respondents. Nevertheless, a quarter of respondents indicated they would take the views of others into account when making a purchasing decision.

Figure 5: Perceived importance of product attributes in consumer decision-making



Source: Authors

We observed statistically significant differences across several criteria by employing Mann-Whitney U tests to evaluate the importance of product attributes in men's and women's purchasing decisions. Specifically, concerning the price of a product ($z = -3.021$, $p = 0.003$), men ($M = 4.36$) rated this attribute as more important than women ($M = 4.15$). Similarly, men ($M = 3.33$) assigned greater importance to the brand compared to women ($M = 2.82$) ($z = -4.252$, $p = 0.000$). Additionally, men ($M = 3.42$) considered product design to be more important than women ($M = 3.06$) ($z = -2.848$, $p = 0.004$). This trend continued with the country of origin, where men ($M = 3.16$) deemed this attribute more significant than women ($M = 2.82$) ($z = -2.376$, $p = 0.018$).

Using the Kruskal-Wallis H test, statistically significant differences in perceptions of product attributes were identified among different age groups. The first notable difference was related to the price of the product ($\chi2(4) = 15.663$, $p = 0.004$). Respondents aged 56-69 ($M = 4.57$) placed a higher value on product pricing compared to those in the 26-39 ($M = 4.15$) and 40-55 ($M = 4.06$) age groups. Regarding the importance of brand, the results showed significant

variation ($\chi2(4) = 20.412$, $p = 0.000$), with respondents aged 26-39 (M = 2.74) indicating that brand was considerably less important than those <25 years old (M = 3.19). The perception of product design exhibited a similar trend ($\chi2(4) = 26.579$, $p = 0.000$): respondents from the 26-39 age group (M = 2.79) valued design less than those in the <25 group (M = 3.52). Lastly, the significance of the country of origin was highlighted ($\chi2(4) = 39.908$, $p = 0.000$), with respondents aged 56-69 (M = 3.97) and 70+ (M = 3.65) considering it more important than younger respondents (<25: M = 2.54; 26-39: M = 2.81; 40-55: M = 3.11). Comparisons of the importance of product attributes among respondents of different education levels did not yield statistically significant results.

5. Discussion and conclusions

The analysis based on our sample showed that respondents try to behave responsibly, plan their purchases and avoid impulse buying. In addition, the majority do not consider prices below the rounded-up prices to be more attractive or that products with these prices are on sale. The question of whether a higher price is associated with higher product quality was also assessed neutrally. They also demonstrated neutrality when choosing between more expensive branded products and less expensive products without a well-known brand. Despite their fundamentally rational views, however, the respondents also stated that they often purchase interesting products that they had not planned for and spend more than they had intended. They also stated that they often regret having spent a lot of money, but rarely returned products to the shop because they had spent too much. The above can be interpreted to mean that respondents recognise the idea of conscious and rational buying, but stumble over it in certain situations, especially when confronted with attractive offers or products. This aligns with Herbert Simon's (1965) well-known interpretation, which posits that the decision maker tends to act rationally but often fails to do so due to various constraints, settling for decisions that are merely "good enough." In addition, respondents tend to buy during special offers, are brand loyal and habitually buy the same products regardless of whether they are on sale or not, again expressing contradictions in their attitudes. When asked about the most important factors when choosing a product, they state: quality, price, design, brand, country of origin and the opinion of others.

Analysing the sample according to the demographic characteristics of the respondents also led to some interesting findings. Male respondents consider themselves to be more responsible and aware buyers who make quick decisions when faced with time-limited offers. However, they also tend to impulse buy more than women and are more likely to buy during sales. In addition, men round prices down more often than women, see .99 prices as discounts, and prices set this way are more attractive to them. They also tend to assume that a higher price means higher quality. Finally, to complete the contradiction in the attitudes expressed, men are more likely than women to spend more money when shown a product they are interested in but do not intend to buy. Women are more loyal customers, they buy the same tried and tested products more often, and they buy when they really need the product. According to them, they also attach less importance to price, brand, design and country of origin than men.

In line with previous research, the youngest respondents tend to buy on impulse, while respondents from older age groups are more likely to plan. Similarly, the youngest group of shoppers are the least likely to keep a shopping list, and the brand and design of the product are most important to them. Older respondents (56+) are more likely to buy products on sale than other age groups, and the most important factor when buying is price, which can be explained by this age group's lower income or expectations of future income. However, they consider the

.99 prices to be the most attractive, which means that the psychological effect of such prices is most pronounced for them. Finally, the 56+ age group considers the country of origin to be more important than other age groups.

When analysing preferences and habits by level of education, it was likely, in line with previous research, that respondents with the highest level of education planned their purchases and carried a shopping list with them. The least educated were most likely to round up the price. Interestingly, the group of respondents with the lowest level of education were the least likely to make unplanned purchases of interesting products and spend more than planned, again likely due to lower income. Differences in education levels did not lead to differences in impulsive spending and subsequent regret, nor in the evaluation of the importance of product features.

Understanding consumer reactions to psychologically set prices is all the more important as the world is currently in a situation of global instability, and more difficult economic times are expected. Therefore, the pressure on consumers to save is likely to be greater, and in light of this, it is again necessary to closely monitor consumer attitudes and reactions.

The results of this research offer valuable insights into general consumer shopping behaviour, which are essential for understanding market dynamics and informed business decision-making. However, the specific characteristics of different consumer groups – such as different habits, tendencies towards impulsive buying behaviour and the importance placed on specific product features – may be even more important for practical business applications. These nuances enable companies to tailor their marketing strategies and product offerings to the particular needs and preferences of their target market segments, thereby enhancing business efficiency, fostering customer loyalty, and gaining a competitive advantage in the marketplace. To identify these behavioural differences among specific buyer groups, a comparative analysis of respondents' answers was conducted based on their gender, age group and education level.

Although this research provides valuable insights into consumer responses to psychological pricing strategies, it is not without limitations. First, the data was collected exclusively through an online survey distributed via social media, which may lead to self-selection bias and limit the representativeness of the sample. Second, although the sample includes various demographic characteristics, it does not necessarily reflect the broader Croatian population in terms of income, regional distribution or shopping frequency. Thirdly, the cross-sectional design of the study captures consumer attitudes and behaviours at a single point in time, which may not fully account for situational or temporal factors (e.g. inflation, holiday periods). In addition, the study focuses primarily on self-reported perceptions and behaviours, which may differ from actual purchasing decisions in real-life contexts. In the continuation of this research, particular attention will be paid to analysing consumer reactions to anchored prices in order to gain a deeper understanding of their influence on value perception and purchasing decisions. In addition, econometric methods - in particular regression analysis- will be employed to determine statistically significant relationships between consumer characteristics and their preferences for certain pricing strategies. Moreover, future research could benefit from experimental methods to validate and extend these findings.

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REFERENCES

Monroe, K. B. (2003): ***Pricing: Making profitable decisions*** (3rd ed.), Routledge.

Nagle, T. T., & Müller, G. (2018): ***The strategy and tactics of pricing: A guide to growing more profitably*** (6th ed.), Routledge.

Thomas, M., & Morwitz, V. G. (2005): **Penny wise and pound foolish: The left-digit effect in price cognition**, Journal of Consumer Research, *32*(1), pp. 54–64. https://doi.org/10.1086/429600

Bizer, G. Y., & Schindler, R. M. (2005): **Direct evidence of ending-digit drop-off in price information processing**, Psychology & Marketing, *22*(10), pp. 771–783. https://psycnet.apa.org/doi/10.1002/mar.20084

Melnik, M. I., & Alm, J. (2005): ***Seller reputation, information signals, and prices for heterogeneous coins on eBay***, Southern Economic Journal, *72*(2), pp. 305–328. https://doi.org/10.1002/j.2325-8012.2005.tb00704.x

Stiving, M. & Winer, R. S. (1997): ***An empirical analysis of price endings with scanner data***, Journal of Consumer Research, *24*(1), pp. 57–67. https://doi.org/10.1086/209493

Lichtenstein, D. R., Ridgway, N. M. & Netemeyer, R. G. (1993): ***Price perceptions and consumer shopping behavior: A field study***, Journal of Marketing Research, *30*(2), pp. 234–245. https://doi.org/10.1177/002224379303000208

Tversky, A. & Kahneman, D. (1974): ***Judgment under uncertainty: Heuristics and biases***, Science, *185*(4157), pp. 1124–1131. https://doi.org/10.1126/science.185.4157.1124

Huber, J., Payne, J. W. & Puto, C. (1982): ***Adding asymmetrically dominated alternatives: Violations of regularity and the similarity hypothesis***, Journal of Consumer Research, *9*(1), pp. 90–98. https://doi.org/10.1086/208899

Ariely, D. (2008): ***Predictably Irrational: The Hidden Forces That Shape Our Decisions***, HarperCollins. https://psycnet.apa.org/record/2008-04432-000

Yadav, M. S. & Monroe, K. B. (1993): ***How buyers perceive savings in a bundle price: An examination of a bundle's transaction value***, Journal of Marketing Research, *30*(3), pp. 350–358. https://doi.org/10.1177/002224379303000306

Grewal, D., Monroe, K. B. & Krishnan, R. (1998): **T*he effects of price-comparison advertising on buyers' perceptions of acquisition value, transaction value, and behavioral intentions***; *Journal of* Marketing, *62*(2), pp. 46–59. https://doi.org/10.1177/002224299806200204

Zhang, J., & Monroe, K. B. (2011): ***The influence of spurious discount claims on consumers' perceptions and purchase intentions***. Journal of Retailing, *87*(2), pp. 156–166. https://doi.org/10.3390/bs11020016

Bettiga, D., Bianchi, A. M., Lamberti, L., & Noci, G. (2020): ***Consumers Emotional Responses to Functional and Hedonic Products: A Neuroscience Research***, Frontiers in psychology, 11, 559779. https://doi.org/10.3389/fpsyg.2020.559779

Lopes, A., Amaro, S., & Henriques, C. (2023): ***Gender Differences in Factors Affecting Impulsive Buying Behavior***, In J. Santos, I. Pereira, & P. Pires (Eds.), Management and Marketing for Improved Retail Competitiveness and Performance (pp. 341-357), IGI Global Scientific Publishing. https://doi.org/10.4018/978-1-6684-8574-3.ch016

Filipas, A. M., Vretenar, N., & Prudky, I. (2023): ***Decision trees do not lie: Curiosities in preferences of Croatian online consumers***, Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu, 41. (1), pp. 157-181. https://doi.org/10.18045/zbefri.2023.1.157

Thomas, A.K.; Louise, R. & Vipinkumar, V.P. (2018): ***Impact of visual merchandising, on impulse buying behavior of retail customers***, Int. J. Res. Appl. Sci. Eng. Technol. 6, pp. 474–491.

Florea, N.-V., Croitoru, G., Coman, D.-M. & Coman, M.-D. (2025): ***The Influence of Fashion Retailers on Customer Psychology Using Visual Merchandising and Store Layout to Improve Shopping Decision***, Journal of Theoretical and Applied Electronic Commerce Research, 20(1), 40. https://doi.org/10.3390/jtaer20010040

Wadhwa, M. & Zhang, K. (2015): ***This Number Just Feels Right: The Impact of Roundedness of Price Numbers on Product Evaluations,*** Journal of Consumer Research, 41(5), pp. 1172–1185. https://doi.org/10.1086/678484

Gaston-Breton, C. (2011): ***Consumer Preferences for 99-ending prices: the mediating role of price consciousness***, DEE - Working Papers. Business Economics. WB wb110503, Universidad Carlos III de Madrid. Departamento de EconomÃ-a de la Empresa.

Nambiar, R. R. (2025): ***Visual Merchandising as a Tool for Increasing In-Store Footfall***, Journal of Business Management and Information Systems, 12(1), pp. 37–45. https://doi.org/10.48001/jbmis.1201004

Redine, A., Deshpande, S., Jebarajakirthy, C., & Surachartkumtonkun, J. (2023): ***Impulse buying: A systematic literature review and future research directions***, International Journal of Consumer Studies, 47(1), pp. 3–41. https://doi.org/10.1111/ijcs.12862

Sundström, M., Hjelm-Lidholm, S. & Radon, A. (2019): ***Clicking the boredom away – Exploring impulse fashion buying behavior online***, Journal of Retailing and Consumer Services, 47(), pp. 150–156. https://doi.org/10.1016/j.jretconser.2018.11

Ortega, A. M., & Tabares, F. A. (2023): ***Psychological pricing: Myth or reality? The impact of nine-ending prices on purchasing attitudes and brand revenue***, Journal of Retailing and Consumer Services, 71, 103206. https://doi.org/10.1016/j.jretconser.2022.103206

Bujisic, M., Bujisic, V., Parsa, H., Bilgihan, A. and Li, K. (2024): ***Anchoring decisions: the role of decoy pricing in consumer choices***, International Hospitality Review, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/IHR-04-2024-0023

Zong, Y., & Guo, X. (2022): ***An Experimental Study on Anchoring Effect of Consumers' Price Judgment Based on Consumers' Experiencing Scenes***, Frontiers in Psychology, 13, 794135. https://doi.org/10.3389/fpsyg.2022.794135

Simon, H. A. (1956): ***Rational choice and the structure of the environment***, Psychological Review, 63(2), pp. 129–138. https://doi.org/10.1037/h0042769

A scientific paper

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FINANCIAL AND ORGANIZATIONAL CONSEQUENCES OF MERGERS IN PUBLIC SECTOR – MERGER POTENTIALS OF THE KINDERGARTENS IN THE CITY OF ZAGREB

ABSTRACT

Mergers are a widely known and accepted concept for streamlining business operations in the corporate sector. Their primary purpose is to simplify and improve the efficiency of organizations, mainly through the reduction of administrative burdens and costs. In such processes, assets and liabilities are transferred to a newly established company formed by the merger. However, since mergers in the public sector are relatively rare, their potential remains largely unexplored.

The aim of this paper is to analyze the potential benefits of merging kindergartens in the City of Zagreb. In addition to internal benefits—such as the simplification of administrative processes and the potential reduction of operational costs—the research also addresses challenges and obstacles arising from the external environment related to the merger process.

The methodology is based on an analysis of publicly available employee data from 60 kindergartens founded by the City of Zagreb. The research presents a generic organizational structure common to each kindergarten, developed by the authors based on publicly available data.

Using this case study, the paper compares the similarities and differences in the merger process between the private and public sectors. Key factors for the successful implementation of a merger in kindergartens are identified. The study also proposes an organizational structure for the new entity resulting from the proposed merger, drawing on a comparable example from the healthcare sector. Finally, the potential benefits of merging kindergartens are analyzed from the broader perspective of the public sector as a whole.

Key words: *mergers, public sector, kindergartens.*

1. Introduction

In the 2023/2024 school year, there were a total of 1.744 kindergartens in the Republic of Croatia, employing 26.397 individuals. Of these, 1.333 kindergartens are owned by local communities (Croatian Bureau of Statistics, 2024). Formally, kindergartens are independent

legal entities with their own management (the principal) and governing boards. However, when analyzing the legal framework, particularly the Preschool Education Act (2023), It becomes evident that kindergartens operate as subsidiaries of local authorities, with minimal independence. Consequently, the rationale behind maintaining multiple kindergartens—each an independent legal entity—within a single local community is unclear, as there is no apparent business justification for such an approach.

This paper defines the concept of mergers and compares the approach to mergers between private entities and the public sector. As a case study, we examine the current situation in preschool education in the City of Zagreb and explore the possibility of mergers aimed at streamlining business processes to enhance the value of existing activities. We discuss the potential for reducing administrative overhead and operational costs, focusing on the number of administrative staff and educational councils. Additionally, based on the presented data, we argue that any potential savings should not be viewed solely as a cost-cutting measure, but rather as a cost-shifting strategy intended to improve the quality of services provided to the community, as kindergarten activities are not profit-oriented.

2. The concept of mergers

Mergers are a well-established concept in the business sector, with the first instances occurring between 1895 and 1905 in the U.S. manufacturing industry, during which more than 1,800 companies were consolidated (Choi, 2011, p. 1). Mergers are often referred to as "mergers and acquisitions" (M&A), as a merger typically involves a process in which "only one corporation survives, while the merged corporation ceases to exist" (Duksaite & Tamošiūnienė, 2009). The primary goal of most merger activities is to exploit the synergistic effects of value chains between two organizations (Ferreira et al., 2012). In addition to operational and financial synergies, other motivations for mergers and acquisitions (M&A) include product and market diversification, strategic realignment, the acquisition of undervalued assets, managerialism, tax considerations, market power, and misvaluation (DePamphilis, 2019, p. 9).

Mergers are also not uncommon in the public sector, particularly within government agencies, where the goal is to redefine how the newly formed government will operate (Frumkin, 2003). A clear example of this occurs after each national election. In Croatia, the 14th government term consisted of 21 ministries (Ordinance, 2016). In contrast, the 15th government term consisted of 16 ministries (Ordinance, 2020). The number of ministries decreased due to the consolidation of several ministries. For instance, the Ministry of Justice and Administration was formed by merging the Ministry of Justice with the Ministry of Administration, while the Ministry of Labor, Pension System, Family, and Social Policy resulted from the merger of the Ministry of Labor and Pension System with the Ministry of Demography, Family, Youth, and Social Policy. A notable example in the City of Zagreb is the merger of health centers. Today, three health centers, created in 2002 through the merger of 12 previous centers, operate under the names Health Center - East, Health Center - Center, and Health Center - West (Health Center - East, 2009; Health Center - Center, 2009; Health Center - West, 2009).

In both of these examples, the consequence of the mergers was a reduction in the number of directors and management board members, along with the consolidation of administrative processes. The results of these mergers support the justification for such actions in the public sector, as evidenced by improvements in public service delivery, reductions in administrative staff, professionalization of personnel, and the strengthening of the autonomy of the merged

institutions (Steiner & Keiser, 2016). This effort aligns with the ComPAct – a strategic set of actions from the EU aimed at fostering responsible behavior related to sustainable management practices, developing high-quality services, improving administrative performance (specifically for the responsible use of national and local budgets), and retaining a professional and stable workforce (European Commission: Directorate-General for Structural Reform Support, 2023, pp. 3-5). Mergers are one of the tools in contemporary public management that, through reforms, seeks to reduce the bureaucratic burden on public administration and transform social policies in line with economic possibilities (Fiala & Sovovoa, 2019, p. 141).

An example of a merger in Croatian education is the consolidation of the Teachers' College in Čakovec, the Teachers' College in Petrinja, and the Faculty of Teacher Education at the University of Zagreb. Following the merger, the Faculty of Teacher Education in Zagreb became the new headquarters for the newly formed faculty (Miljković & Šimrak, 2019, p. 13). Mergers in higher education are relatively common, as they are expected to "boost efficiency and effectiveness, address organizational fragmentation, broaden student access and implement equity strategies, increase government control over higher education systems, enhance decentralization (autonomy), and establish larger organizations" (Pinheiro et al., 2016). Moreover, mergers enhance long-term student outcomes by boosting school productivity (Sandsør et al., 2021). Although economies of scale are one of the main drivers of mergers, the results have been less encouraging. Cost-wise, in their study of rural school districts in New York, Duncombe and Yinger (2001) concluded that the larger the size of the merged districts, the smaller the net impact on cost reductions. Therefore, mergers in the public sector do not necessarily lead to a reduction in operating costs, at least not in the short term. This fact can present a significant obstacle to improving the public sector, as the electoral cycle often promotes short-term thinking, which affects the organizational efforts of public sector organizations and agencies (Ogami, 2024). In other words, mergers and reorganization efforts in the public sector are not only matters of economics but also matters of politics.

These arguments are applicable to preschool education, although the topic of mergers in this sector has not been thoroughly explored to confirm their validity. In preschool education, mergers, along with reorganization, are driven by economic considerations related to streamlining business activities. However, they are also closely tied to political cycles (Inoue, 2020), as, in the case of Croatian preschool institutions, management serves a 4-year term (for the managing board) or a 5-year term (for the principals). In summary, mergers of educational institutions have generally been successful, despite initial institutional and community resistance, as well as short-term cost increases (Harman & Harman, 2003).

3. Kindergartens in the City of Zagreb – present situation

In the City of Zagreb, there are a total of 127 kindergartens, 60 of which are founded by the City of Zagreb across 234 locations (Grad Zagreb, 2025). In total, more than 5.500 employees work in the kindergartens of the City of Zagreb. It is important to note that this data is based on currently available information and may be subject to minor discrepancies due to potentially outdated records. This structure ensures the proper organization and management of kindergartens, facilitating their daily operations. The distribution of employees across different categories reflects the system's needs and supports the uninterrupted performance of all operational and administrative duties.

3.1. Generic organizational structure

All kindergartens owned by the City of Zagreb share the same generic organizational structure, which is based on the initial form of a functional organization, with each department focused on a specific business function (Zovko, 2018, p. 36). Each kindergarten is governed by a management council. The role of the management council is similar to that of the supervisory board in a two-tier corporate governance system (Gad, 2015). Moreover, the management council holds greater authority than the supervisory board in a corporate setting, as it is responsible not only for making strategic decisions but also for many operational tasks, such as preparing the annual plan of activities, recruiting new personnel, and overseeing other operational activities. This structure is not unique to kindergartens owned by the City of Zagreb. In Croatia, all publicly owned kindergartens have a management council with the same responsibilities, as defined by Article 35 of the Preschool Education Act (2023).

In the kindergartens of the City of Zagreb, the management council consists of one employee representative, one parent representative, and three representatives of the City of Zagreb. Similar to the supervisory board in a corporate setting, none of the City of Zagreb representatives are employees of the kindergarten (except for the employee representative).
The principal is the true top manager, as they legally represent the kindergarten. However, the principal's responsibilities are limited and primarily focused on managing day-to-day activities, as prescribed by the Preschool Education Act and the statute. Regarding strategic decisions and many human resources matters (such as personnel employment), the principal only submits proposals to the management council, which makes the final decisions. In its general structure, the principal oversees three main departments: administration, support services, and operations (educational services).

The principal is advised by an expert team, the size of which varies across kindergartens, but this team typically does not have direct subordinates. The administration department is usually led by the kindergarten secretary and consists of employees working in accounting and legal services. The support services are generally led by a healthcare worker (usually a registered nurse) and include two departments: the kitchen, which is managed by a chief cook and assistant chefs, and the maintenance department, which includes janitors, cleaners, housekeepers, laundry personnel, and other low-skilled workers.

The operations department is responsible for educational activities and consists of educational groups, nursery groups, and preschool preparation groups. Each group is led by two preschool teachers, except for the nursery group for children aged 6 to 12 months, which is led by three preschool teachers. The size of these groups and the number of personnel per group are determined according to the National Pedagogical Standard of Preschool Education (2010). A preschool education group can have a maximum of 20 children enrolled, while the size of other groups is determined based on the age of the children, as shown in Table 1.

Table 1: Maximum number of children in educational groups

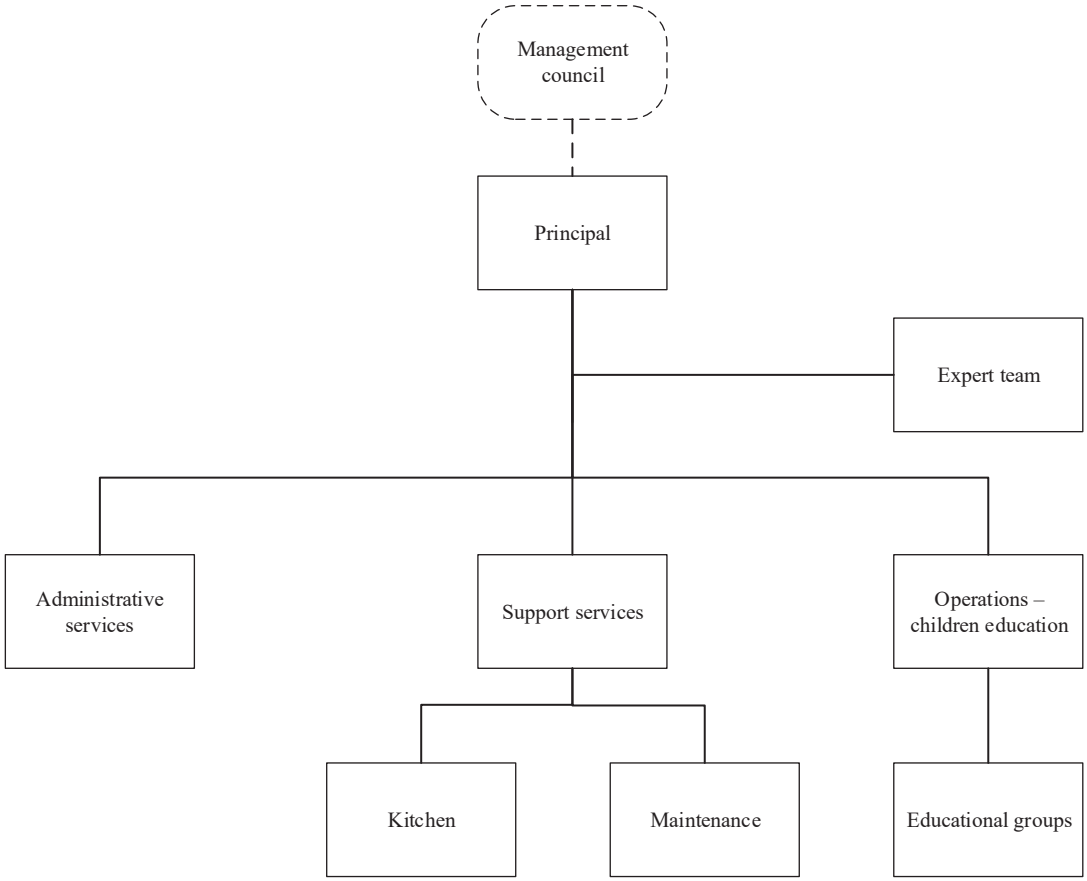
Age of children	Size of the educational group (number of children)
6 - 12 months	5
13 - 18 months	8
19 - 24 months	12
3 years of age	14

Age of children	Size of the educational group (number of children)
4 years of age	18
5 years of age	20
6 years of age	23
7 years of age	25
mixed groups	
1 - 2 years of age	10
1 - 3 years of age	12
3 years of age until school age	20
4 years of age until school age	22

Source: The National Pedagogical Standard of Preschool Education (2010)

Although there is some flexibility in the employment policies of kindergartens, particularly regarding administrative and support services, the number of preschool teachers is strictly determined by the age of the children and, consequently, by the size of the educational groups. The generic organizational structure is shown in Figure 1.

Figure 1: Generic structure of the kindergartens of the City of Zagreb



Source: Authors

3.2. Human resources costs – salaries

The City of Zagreb owns 60 kindergartens, each of which has its own principal. There is an equal number of speech therapists, as well as 67 psychologists and 78,5 healthcare coordinators (including one part-time employee). Administrative and accounting tasks are handled by 64 secretaries, 105 administrative-accounting staff members, and 64,5 heads of accounting. A total of 3.522,5 educators are employed, while the maintenance department consists of 61 warehouse managers and 136 maintenance workers (janitors).

Kitchen operations are overseen by 71 head chefs, and laundry services employ 95 workers. Additionally, 730 cleaners are responsible for cleaning services.

All data was collected from the official websites of each individual kindergarten—their Annual Plan and Program for the 2024/2025 academic year—and may vary due to significant fluctuations in staffing, primarily caused by temporary employees hired as replacements during prolonged sick leave or maternity leave. Regarding salaries, as no publicly available data exists, we calculated the annual salaries of the employed personnel based on their numbers. These calculations were made according to the parameters defined by the Collective Agreement (The City of Zagreb, 2024). The Collective Agreement defines the basic salary as the product of the salary base (€792.44) and the coefficient assigned to each position. Additionally, the basic salary is increased based on work experience; however, this increase was not accounted for, as we could not access specific data for each employee. Another limitation is that salary increases for preschool teachers and principals, based on their professional advancement titles, as well as the principal's salary increase based on the number of educational groups in the kindergarten, were not included in the calculation. In other words, the personnel salary costs presented in Table 2 reflect the minimum required budget for basic salaries, without considering any specific increases or other material rights prescribed by law or negotiated through the Collective Agreement. Based on our calculations, the total annual minimum cost for employee salaries amounts to at least €128.484.446,53

Table 2: Cost of salaries for the kindergartens owned by the City of Zagreb

Job title	Number of employees	Salaries total	
		Per month	Annual
the principal	60	164.035,08	1.968.420,96
speech therapist	60	129.326,21	1.551.914,50
psychologist	67	144.414,27	1.732.971,19
educational rehabilitator	47	101.305,53	1.215.666,36
pedagogue	85	183.212,13	2.198.545,54
defectologist	9	19.398,93	232.787,17
healthcare worker	78,5	165.469,40	1.985.632,76
kindergarten secretary	64	134.904,99	1.618.859,83
administrative worker	15	23.773,20	285.278,40
head of accounting	64,5	139.025,67	1.668.308,08
accountant	90	142.639,20	1.711.670,40
preschool teacher	3522,5	7.425.043,93	89.100.527,21
warehouse manager	61	95.092,80	1.141.113,60
janitor	136	213.958,80	2.567.505,60
chef	71	112.526,48	1.350.317,76
assictant cook	367	529.302,37	6.351.628,48
laundry personnel	95	103.730,40	1.244.764,75

Job title	Number of employees	Salaries total	
		Per month	Annual
husekeeper - cleaner	730	879.877,83	10.558.533,96
Total	5622,5	10.707.037,21	128.484.446,53

Source: Author's own calculation based on data from Annual Plan and Program for the 2024/2025 academic year for kindergartens of the City of Zagreb

4. Proposed concept – one legal entity

4.1. Rationale for the merger

As previously discussed, the primary motivations for mergers are operational and financial synergies. In the case of public institutions like kindergartens, the main driver for mergers is operational synergy, as the cost of capital is less of a concern in the public sector than the efficient provision of public services. Operational synergy primarily arises from economies of scale, particularly in administrative services, and to a limited extent from economies of scope related to special educational services provided by the expert team.

Since kindergartens must remain accessible and locally responsive, mergers cannot result in the reduction of facilities or the number of operational staff, such as preschool teachers. The aim is to streamline administrative and, to some extent, support services. Additionally, when examining the job description of a kindergarten principal, it becomes clear that the principal is primarily responsible for operational decisions. Although the principal is the legal representative of the kindergarten and bears sole responsibility for the legality of operations, in terms of decision-making authority, the principal resembles a first-level manager, as medium-term and strategic decisions are made by the management board.

Thus, the management board functions as the true top management of the kindergarten, despite not being employees of the institution (except for the employee representative). The purpose of the merger, beyond creating operational synergy, is to redefine the decision-making structure in line with corporate management practices, where the mechanism for overall strategy is positioned within the organization (Thys et al., 2023) in a form of the true top management. The final outcome would be a two-tier corporate model, with the transformation of the management board into a supervisory board, whose primary function would be to oversee the board of directors. The principal, along with the directors, would form the board of directors, responsible for all management-related issues and for setting long-term goals and guidelines. Importantly, as stated by Jungmann (2006), “Simultaneous membership of the management board and the supervisory board is not permitted.”.

4.2. Comparable institution

Since there are no examples of mergers in preschool education in Croatia, and other educational institutions have not undergone consolidation (universities have independent faculties, and the same is true for primary and secondary schools), we used the Clinical Hospital Centre “Sestre Milosrdnice” (KBCSM) in Zagreb as a comparable example to gain insight into the potential of mergers.

KBCSM has 863 inpatient beds and 2,478 employees. It operates 16 clinics, 6 departments (3 of which are clinical), a Unified Emergency Hospital Admission unit, a hospital pharmacy, the

Institute for Clinical Medical Research, numerous non-medical departments, and 28 reference centers of the Ministry of Health across three locations (KBCSM, 2025). Compared to the €153,115,439.66 in revenue generated by the 60 kindergartens, KBCSM generated €317,088,906.75 in 2024, which is 107.09% more. Despite having fewer than 50% of the employees compared to the kindergartens in the City of Zagreb, KBCSM has a more complex organizational structure, with a broader range of products and services. This results in less predictable business operations, making planning, management, and administration far more intricate than in the case of kindergartens.

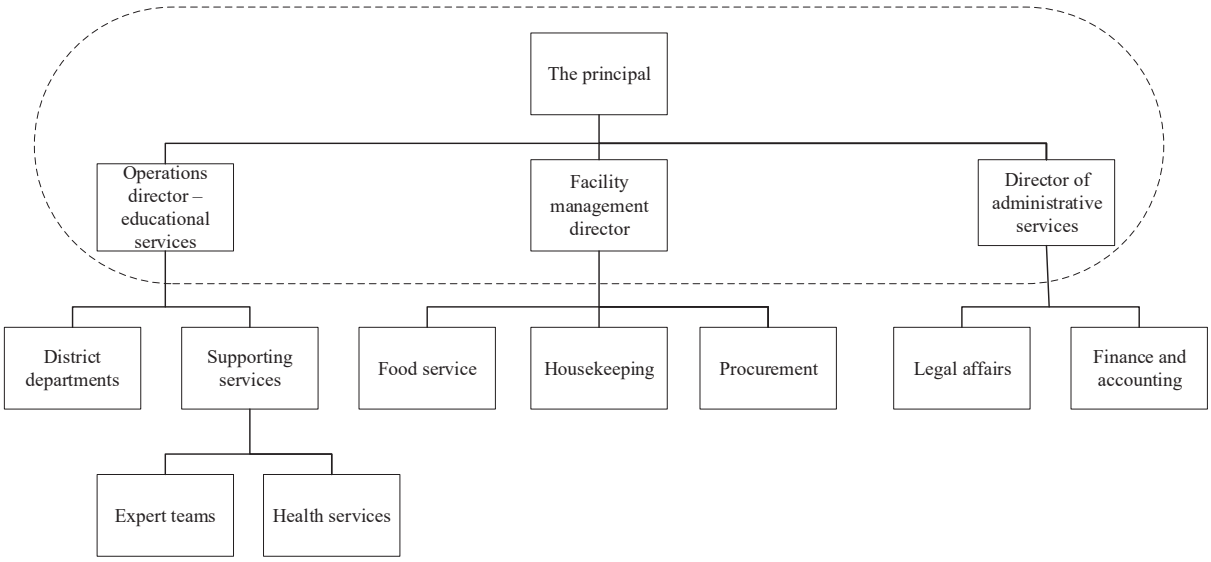
Both organizations provide different public services, and their processes can be categorized into managerial, core, and support activities (Dumas et al., 2018, 55). Given the differences in their core client bases, the personnel engaged in core processes at the two institutions are not directly comparable. However, the managerial and support activities can be compared. Kindergartens employ 292.5 workers in administrative services, while KBCSM employs 263 (KBCSM, 2024). At first glance, the numbers may not appear to differ significantly, but a closer analysis of the administrative service structures reveals key differences. KBCSM has one director, one vice director, and five deputy directors, along with an additional six employees in the director's office responsible for administration. In contrast, kindergartens have a total of 60 principals and 64 secretaries. This means that in the area of managerial processes, KBCSM's top management office consists of 13 members, while kindergartens have 124 members—an 853.85% higher personnel count dedicated to managerial activities.

Another interesting area for comparison is the accounting department, which represents support activities. Despite the fact that kindergartens manage over 5,500 employees and serve more than 29,000 children, KBCSM, with only half the number of employees, provided services to nearly 50,000 patients and handled approximately 4.5 million services (authors' estimation based on the report from The State Audit Office, 2024). In this context, the kindergarten accounting department employs 154.5 staff members, while KBCSM's accounting department, along with its billing and revenue departments, employs a total of 47 people. KBCSM's operational procurement department, which also manages the internal warehouse and maintains direct communication with suppliers, consists of 14 employees. In contrast, each kindergarten has one warehouse manager, with a total of 60 across all institutions. Additionally, KBCSM has a dedicated legal department with 13 employees, whereas kindergartens do not have a separate legal department; instead, the 64 secretaries are responsible for handling legal affairs.

4.3. Changes in organizational structure

An organizational structure change is a result of broader organizational change, aimed at aligning operations with a changing environment (Král & Králová, 2016). Kindergartens are facing increasingly demanding clients (parents) and rising administrative costs. The goal of the proposed organizational structure transformation is to streamline administrative processes and improve efficiency. The new structure, which draws on KBCSM as a comparator, aims to reduce management functions while strengthening the role of the principal and their deputies. While the existing organizational structure groups business functions into three main areas—administration, support services, and operations—we propose that these groupings remain but be elevated to a higher level in the new structure. The proposed organization is presented in Figure 2.

Figure 2: Proposed organization structure of consolidated kindergartens in the City of Zagreb



Source: Authors

The proposed organizational structure streamlines administrative services by reducing management from 60 principals to four professional managers, following a contemporary corporate model with a board of directors. The 60 accounting departments are centralized into one, and a new legal affairs department is established. Expert teams are consolidated into a single department, and a new health services department is created. Centralizing food service, housekeeping, and procurement leads to a more efficient support services structure.

In terms of personnel, the proposed organizational changes are expected to result in a reduction of 283.5 job positions (see Table 3), with annual savings in salaries estimated at €6.430.749,45 (see Table 4).

Table 3: Perceived decrease of the total personnel after the merger

Job group	Before the merger		After the merger		Decrease	
	Number	Ratio in total no. of employees	Number	Ratio in total no. of employees		
administration	293,5	5,22%	56	1,05%	237,5	80,92%
expert advisors	346,5	6,16%	346,5	6,49%	0,0	0,00%
preschool teacher	3.522,5	62,65%	3.522,5	65,98%	0,0	0,00%
support services	1.460,0	25,97%	1.414	26,48%	46,0	3,15%
total	5.622,5		5.339		283,5	

Source: Authors

Table 4: Perceived savings in salaries after the merger (in euro)

Job group	Monthly salary			Monthly salary		
	Before the merger	After the merger	Difference	Before the merger	After the merger	Difference
administration	604.378,14	115.030,59	489.347,55	7.252.537,67	1.380.367,08	5.872.170,59
expert advisors	743.126,46	743.126,44	0,02	8.917.517,51	8.917.517,28	0,23
preschool teacher	7.425.043,93	7.425.043,93	0,00	89.100.527,21	89.100.527,21	0,00
support services	1.934.488,68	1.887.940,46	46.548,22	23.213.864,15	22.655.285,52	558.578,63
Total	10.707.037,21		535.895,79	128.484.446,53	122.053.697,09	6.430.749,45

Source: Authors

5. Discussion

The proposed concept for the new organization of the kindergarten demonstrates significant potential economic benefits, particularly in terms of salary savings. However, several limitations must be noted. First, the approach is based on a comparator from a different sector, meaning the proposed personnel cuts in administration do not accurately reflect the actual business processes involved in providing preschool services. Additionally, the potential savings are limited to salaries, which reflect a very conservative approach, as the calculation does not account for all material rights of personnel. Furthermore, salaries are calculated based on the minimal requirements for specific job positions. For example, the salary calculation for 3.515,5 preschool teachers assumes that all teachers hold a bachelor's degree with a basic gross salary of €2.107,89, even though a substantial number of teachers hold a master's degree, earning a higher base gross salary of €2.155,44.

Moreover, salaries are not the only costs; there may be significant differences in other areas related to the administration and functioning of 60 separate entities versus a single legal entity. These include transaction costs, procurement, and various services, all of which could benefit from economies of scale. For example, each kindergarten, as an individual legal entity, is governed by a management council consisting of five members, each of whom is entitled to compensation for attending meetings. Assuming that each kindergarten holds five management council meetings per year, this results in 300 meetings and a total of 1,500 compensations annually. In contrast, a single legal entity would require only 25 compensations for five meetings per year.

Based on financial reports from each individual kindergarten, the total revenue of kindergartens in the City of Zagreb amounts to €194.474.747,98 while personnel costs total €163.118.029,25. In other words, salaries and employee-related benefits in kindergartens across the City of Zagreb account for 83.88% of their total operating costs. Therefore, focusing on employee costs is more than sufficient to demonstrate the economic potential of mergers in the preschool education sector.

The proposed organizational structure of the new legal entity, the kindergarten after the merger, is a hypothetical model based on publicly available data, aimed at providing insight into the potential benefits of mergers. In reality, before proceeding with streamlining activities and merging 60 kindergartens into one, it is crucial to first map the existing business processes,

define the desired outcomes for each process, identify areas that can be simplified or streamlined, and ultimately propose and standardize new processes (Gupta, 2024). Only after completing these steps should we proceed with the merger activities.

The potential of mergers in preschool education is limited due to the legal framework. As previously mentioned, the legal framework clearly defines the standards related to the provision of educational activities and supporting services. To fully exploit the potential of mergers, the number and type of employees should be directly linked to the exact number of children. Further analysis would reveal which functional areas have personnel numbers below the standard and which have numbers above the standard.

A good example of this is the kitchen. The National Pedagogical Standard for Preschool Education (2010) specifies that for every 400 children, there should be 2,5 chefs and 2,5 assistant cooks. Based on the enrollment of 29.224 children in preschool education programs in 2024, kindergartens in the City of Zagreb should employ 183 chefs and 183 assistant cooks. Currently, all 60 kindergartens employ 71 chefs and 367 assistant cooks. In total, this means that there are 72 more kitchen staff employed than the standard requires (438 workers employed versus 366 workers needed). However, the distribution of kitchen staff does not align with the standard: there is a deficit of 112 chefs and a surplus of 184 assistant cooks.

It should be noted that if adjustments were made to align with the National Pedagogical Standard for Preschool Education (2010), the potential savings in personnel costs would be even greater. However, such an assessment would require an in-depth analysis of the business processes of each individual kindergarten. The proposed merger of kindergartens is a large-scale initiative, involving 60 separate legal entities. As a result, it would have three major implications typical of the public sector: redistribution of power, policy changes, and economic impacts (Halligan, 2015). While this paper primarily focuses on the economics of mergers, it is equally important to consider the redistribution of power. The proposed merger would eliminate 59 principal positions and the corresponding management boards, which currently consist of 295 members. This means that merging the 60 kindergartens into one would centralize power in the hands of just four board members and between five and seven management board members, as defined by the Preschool Education Act.

Policy changes fall within the domain of local government. However, to fully capitalize on the benefits of the merger, some adjustments to the legal framework governing preschool institutions would be necessary. Two major changes would be required: first, modifications to the responsibilities of the managing board (as outlined in Articles 34 and 35 of the Preschool Education Act, 2023), shifting its role to a more supervisory and less operational focus; and second, revisions to the job description of the kindergarten principal, as defined by the statute of each individual kindergarten, to empower them to take on a more strategic role.

Redistribution of power, policy changes, and economic factors are also major obstacles in streamlining business processes. With the redistribution of power, sources of authority not only shift but also diminish. Policy changes move control from the macro environment to the internal environment, while economic factors redefine the human resources structure, shifting from administrative roles to expert roles. All three aspects of mergers directly impact various stakeholders: local politicians and members of the management board would be affected by the redistribution of power and policy changes, as their numbers would decrease, and their influence over operational activities would diminish. Existing principals and administrative

employees would be directly impacted by economic factors, as their job descriptions would change with the likely reduction in the number of administrative and management positions.

6. Conclusion

Mergers in the public sector are not a new concept; however, in the education sector, they have been insufficiently explored, with the exception of higher education. Preschool education in Croatia is highly fragmented, primarily due to the fact that preschool institutions fall under the jurisdiction of local governments, which consist of 428 municipalities and 127 towns and cities (Ministry of Justice, Public Administration and Digital Transformation, 2025). The City of Zagreb is unique in that it owns 60 kindergartens and, therefore, can directly benefit from merging them into a single legal entity, leveraging the operational synergies. However, the full benefits of such a merger should be further explored, as the proposed concept relies on publicly available data without a deeper analysis of business processes and related job positions. Initial research suggests that mergers in education, in general, can have beneficial effects, making the preschool system more manageable and providing better value for money. In addition to the economic benefits, further research on the political and policy aspects is needed to assess the long-term viability of mergers.

REFERENCES

Choi, S. (2011): ***Competing logics in hospital mergers - The case of the Karolinska University Hospital***., Stockholm, Karolinska Institutet, http://publications.ki.se/xmlui/bitstream/handle/10616/40275/thesis_soki.pdf

City of Zagreb. (2024, 17 July): ***Collective Agreement for Preschool Education – City of Zagreb and Annex IV.***

Croatian Bureau of Statistics, Kindergarten and Other Legal Entities Implementing Preschool Education Programs. Start of Pedagogical Year 2023/2024., https://podaci.dzs.hr/2024/hr/76959

Depamphilis, D. (2018): ***Mergers, acquisitions, and other restructuring activities: An Integrated Approach to Process, Tools, Cases, and Solutions***. Academic Press. London, San Diego, Cambridge

Duksaitė, E., & Tamošiūnienė, R. (2011b): ***Why companies decide to participate in mergers and acquisition transactions***. Mokslas - Lietuvos Ateitis, 1(3), 21–25. https://doi.org/10.3846/145

Dumas, M., La Rosa, M., Mendling, J., & Reijers, H. A. (2018): ***Fundamentals of Business Process Management.*** Springer.

Duncombe, W., & Yinger, J. (n.d.): ***Does school district consolidation cut costs?*** SURFACE at Syracuse University. https://surface.syr.edu/cpr/122

European Commission: Directorate-General for Structural Reform Support. (2023): ***Enhancing the European administrative space (ComPAct).*** Publications Office of the European Union. https://data.europa.eu/doi/10.2887/15593

Ferreira, M. P., Santos, J. C., De Almeida, M. I. R., & Reis, N. R. (2014): ***Mergers & acquisitions research: A bibliometric study of top strategy and international business journals, 1980–2010***. Journal of Business Research, 67(12), 2550–2558. https://doi.org/10.1016/j.jbusres.2014.03.015

Fiala Z, Sovova O. (2019): ***Theory of public administration management – a retrospective view***. International Scientific Conference EMAN Economics & Management: How to Cope With Disrupted Times. Published online January 1, 2019:141-150. doi:10.31410/eman.2019.141

Frumkin, P. (2003): ***Making public sector mergers work: lessons learned***. IBM Center for the Business of Government. https://www.businessofgovernment.org/sites/default/files/PublicSectorMergers.pdf

Gad, J. (2015): ***The relationship between supervisory board and management and their communication processes in publicly listed companies in Poland.*** Comparative Economic Research Central and Eastern Europe, 18(2), 139–160. https://doi.org/10.1515/cer-2015-0016

Grad Zagreb: Most frequent questions (in Croatian9) (2025): https://www.zagreb.hr/najcesca-pitanja/141624

Gupta, D. (2025, March 6): ***10 ways to streamline business processes (2025).*** The Whatfix Blog | Drive Digital Adoption. https://whatfix.com/blog/streamline-processes/

Halligan, J. (2015): ***Coordination of Welfare Through a Large Integrated Organization: The Australian department of human services***. Public Management Review, 17(7), 1002–1020. https://doi.org/10.1080/14719037.2015.1029346

Harman, G., & Harman, K. (2003): ***Institutional mergers in higher education: Lessons from international experience***. Tertiary Education and Management, 9(1), 29–44. https://doi.org/10.1080/13583883.2003.9967091

Inoue, C. (2020): ***Election Cycles and Organizations: How Politics Shapes the Performance of Stateowned Enterprises over Time***. Administrative Science Quarterly, 65(3), 677–709. https://www.jstor.org/stable/48589135

Jungmann, C. (2006): ***The Effectiveness of Corporate Governance in One-Tier and Two-Tier Board Systems – Evidence from the UK and Germany***. European Company and Financial Law Review, 3(4), 426–474. https://doi.org/10.1515/ecfr.2006.019

KBCSM (2024): ***Pravilnik o unutarnjem ustroju i sistematizaciji radnih mjesta Kliničkog bolničkog centra Sestre milosrdnice***, https://www.kbcsm.hr/wp-content/uploads/2024/09/Sistematizacija-2024..pdf

KBCSM (2025): ***Klinički bolnički centar Sestre milosrdnice,*** https://www.kbcsm.hr/o-bolnici/

Kindergarten Poletarac (2025): ***Financial statements***, https://vrtic-poletarac.zagreb.hr/default.aspx?id=78

Král, P., & Králová, V. (2016): ***Approaches to changing organizational structure: The effect of drivers and communication***. Journal of Business Research, 69(11), 5169–5174. https://doi.org/10.1016/j.jbusres.2016.04.099

Miljković, D., & Šimrak, A. B. (2019): ***Učiteljski fakultet Sveučilišta u Zagrebu: 1919.-2019***., Učiteljski fakultet, Zagreb

Ministry of Justice, Public Administration and Digital Transformation (2025): ***List of counties, cities and municipalities***. mpu.gov.hr. https://mpudt.gov.hr/o-ministarstvu/ustrojstvo/uprava-za-politicki-sustav-i-opcu-upravu/lokalna-i-podrucna-regionalna-samouprava/popis-zupanija-gradova-i-opcina/22319?lang=hr

National Pedagogical Standard of the Preschool Education, Official Gazette 63/08, 90/10

Ogami, M. (2024): ***The Conditionality of Political Short-Termism: A review of Empirical and Experimental studies***. Politics and Governance, 12. https://doi.org/10.17645/pag.7764

Ordinance on the Expression of Confidence in the Government of the Republic of Croatia, Official Gazette 95/2016

Ordinance on the Expression of Confidence in the Government of the Republic of Croatia, Official Gazette 86/2020

Pinheiro R., Aarrevaara T., Nordstrand Berg, L., Geschwind, L., Torjesen, D.O. (2016): ***Strategic mergers in the public sector: comparing universities and hospitals in Tarba***, S.Y., Cooper, S.C.L., Sarala, R.M., & Ahammad, M.F. (Eds.). Mergers and Acquisitions in Practice (1st ed.). Routledge. https://doi.org/10.4324/9781315766140

Preschool Education Act, Official Gazette 10/97, 107/07, 91/13, 98/19, 57/22, 101/23

Sandsør, A. M. J., Falch, T., & Strøm, B. (2021): ***Long-run effects of local government mergers on educational attainment and income***. Oxford Bulletin of Economics and Statistics, 84(1), 185–213. https://doi.org/10.1111/obes.12441

Steiner, R., & Kaiser, C. (2016): ***Effects of amalgamations: evidence from Swiss municipalities***. Public Management Review, 19(2), 232–252. https://doi.org/10.1080/14719037.2016.1153704

The Republic of Croatia, The State Audit Office (2024): ***Consolidated report on financial performed audits: Hospital institutions in 2022***., https://www.revizija.hr/UserDocsImages/izvjesca-novo/Revizije%20-%202024/IZVJESCA_%20O_OBAVLJENIM_REVIZIJAMA/FIN_REVIZIJE/BOL_ZDR_USTANOVE/OBJ/Bolnicke%20zdravstvene%20ustanove%20za%202022.pdf

Thys, K., Vandekerkhof, P., Steijvers, T., & Corten, M. (2023): ***Top management team and board of directors as the strategic leadership system: The effect of behavioral integration on***

strategic decision-making quality. European Management Journal, 42(5), 721–734. https://doi.org/10.1016/j.emj.2023.04.010

Zagreb Health Center – Center (2009): ***Statute***, https://dzz-centar.hr/wp-content/uploads/2020/03/Statut-Doma-zdravlja-Zagreb-Centar-032-2020.pdf

Zagreb Health Center – East (2009): ***Statute***, https://dzz-istok.hr/wp-content/uploads/2017/10/Statut-Doma-zdravlja-Zagreb-Istok.pdf

Zagreb Health Center – West (2009): ***Statute***, https://www.dzz-zapad.hr/media/documents/6735596b-fa96-48af-a333-24bd640e9c1e/202101140710270.statut1.pdf

Zovko, V. (2018): ***Menadžment: poslovanje u digitalnom svijetu***. Zagreb: Učiteljski fakultet Sveučilišta u Zagrebu

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THE ROLE OF INNOVATION METRICS IN REGIONAL ECONOMIC DEVELOPMENT: INSIGHTS FROM SOUTHEAST EUROPE

ABSTRACT

Our world is increasingly shaped by rapid technological progress and globalization, making innovation a critical driver for maintaining economic relevance and fostering societal prosperity. Innovation stimulates economic growth by enhancing productivity, strengthening competitiveness, and supporting sustainable development. Well-designed innovation policies not only accelerate technological progress but also create high-quality jobs and enhance both national and regional resilience to economic uncertainties.

This paper examines the importance of innovation metrics in assessing economic development, with a focus on the Global Innovation Index (GII) as a key tool for evaluating national innovation capacity. The study specifically analyzes the innovation performance of Southeast European (SEE) countries, comparing them to the leading country in innovation using selected GII indicators, such as Human Capital and Research, Business Sophistication, and Knowledge and Technology Outputs.

Using secondary data from Global Innovation Index (GII) reports published by the World Intellectual Property Organization (WIPO) and other sources, this research analyzes ranking trends and performance indicators for SEE countries. By identifying key trends and challenges, the paper assesses the influence of innovation-driven policies on regional development and economic transformation. The analysis highlights strengths and weaknesses in the innovation ecosystems of SEE countries and identifies gaps compared to the world's innovation leader.
This study contributes to the broader discourse on the role of innovation metrics in shaping economic policies and investment strategies. It provides valuable insights for policymakers, researchers, and business leaders to support sustainable development and improve the regional competitiveness of SEE countries within the global innovation landscape.

Key words: *innovation, SEE, Global Innovation Index (GII), economic development, innovation metrics*

1. Introduction

Throughout history, the concept of innovation has evolved from a simple idea into a complex process encompassing both technical invention and its commercial application. According to one of the most frequently cited definitions, innovation can be described as the process of transforming an idea into practical application and realization (Trott, 2005). On the macroeconomic level, innovation plays a key role in enhancing productivity, strengthening competitive advantages in international trade, and improving the quality of life of citizens. It is essential for maintaining a dynamic economy capable of adapting to constant changes and challenges.

In modern economies, shaped by rapid technological progress and dynamic transformations, innovation occupies a central place in growth and competitiveness strategies. Beyond redefining how products and services are created, technological change also affects the nature of work, enabling talented individuals to connect with the market in new and more efficient ways. Continuous improvement and the development of new knowledge and skills have become critical factors for competitiveness and the long-term survival of companies, highlighting the importance of innovation for economic success.

The importance of innovation as a foundation for economic growth and development is increasingly recognized by economic actors and policymakers. Just as personal development is essential for individual progress, continuous innovation is necessary for enterprises to remain competitive and achieve sustainable development. The most developed countries of the 21st century are those that have strategically invested in education, science, and technology, thereby creating knowledge and creativity-based societies.

Innovations, ranging from breakthrough technologies to new business models, play a crucial role in shaping modern economies and societies. They not only boost productivity and competitiveness but also contribute to addressing societal challenges, promoting sustainability, and enhancing quality of life. In this context, creating a stimulating environment for innovation has become a strategic priority for countries worldwide. Consequently, measuring innovativeness represents an important process that enables countries to align their development with global trends.

However, assessing innovativeness comes with numerous challenges, as this complex concept cannot be fully quantified using traditional economic indicators such as gross domestic product (GDP) or research and development (R&D) expenditures. Measuring innovation is a multidimensional process that requires the integration of various indicators to provide a comprehensive picture of the innovative capacities of individual countries. There are no universally defined rules on which dimensions of innovation should be measured or which performance indicators are key, which further complicates the process.
To enable comparative analysis of innovativeness among countries, various methodologies have been developed, with the Global Innovation Index (GII) standing out among them. This index provides a comprehensive overview of countries' innovation capabilities and performance by analyzing various indicators, including input factors, innovation outputs, and the innovation-conducive environment. As a key tool for quantifying innovativeness, the GII allows for comparisons of innovative capacities across countries and offers insights into their strengths and weaknesses.

In the context of Southeast Europe, analyzing innovativeness through the Global Innovation Index (GII) provides insight into the current state and helps identify key factors influencing the region's innovation potential. Since innovation serves as a driving force for economic growth and development, understanding the innovation landscape of Southeast Europe can contribute to the formulation of effective strategies for enhancing competitiveness and achieving long-term economic prosperity in the region.

The subject of this research is a comparative analysis of the innovation potential of Southeast European countries over the past five years, using parameters from the Global Innovation Index. Within the GII indicators, special emphasis is placed on Human Capital and Research, Business Sophistication, as well as Knowledge and Technology Outputs.

To gain a deeper understanding of the innovative capacities of Southeast Europe in a regional context, the following questions must be addressed:

- How have countries in the region ranked on the Global Innovation Index over the past five years?
- What are the key innovation areas in which Southeast European countries have advanced or regressed compared to the SEE regional average?

The aim of this paper is to assess the innovation performance of the Southeast European region over the past five years using GII indicators, and to identify the region's strengths and weaknesses in this regard.

Aligned with this aim, the primary objective of the paper is to provide a comprehensive understanding of the innovation landscape in Southeast European countries. This is achieved through an analysis of selected indicators from the Global Innovation Index, with the aim of identifying the region's strengths and weaknesses in comparison to both the highest-ranked Southeast European country and the top-ranked country globally over the past five years. Switzerland is introduced as the reference country, as it consistently holds the position of the most innovative country in the world according to most of the analyzed reports. Based on the Global Innovation Index reports from 2020 to 2024, Slovenia, Malta, and Cyprus have been identified as the top-performing countries within Southeast Europe region.

The paper is structured to begin with a theoretical foundation addressing whether innovations drive economic growth and development, and examining the extent of their importance for national and regional progress. This is followed by a presentation of the research methodology used in the study.

Next, the definition, concept, and structure of the Global Innovation Index are explained.
The central part of this paper presents a comparative analysis of the Southeast European region, utilizing indicators from the Global Innovation Index (GII). Through comprehensive table of country rankings, graphical representations, and detailed result analysis, the study provides insights into the innovation potential of the region. Drawing on GII reports from 2020 to 2024, the overall rankings of the selected countries are presented, with particular emphasis placed on the following indicators: Human Capital and Research, Business Sophistication, and Knowledge and Technology Outputs.

The paper concludes with a summary of key findings and a list of references used in the research.

2. Theoretical background

Innovation is a key driver of regional economic growth, as it enables increased productivity, the creation of well-paid jobs, and the attraction of investment. Particularly important are factors such as the presence of research institutions, technology centers, and innovation policies that foster collaboration between universities and industry. This collaboration facilitates faster knowledge transfer and the application of new technologies in the economy, thereby increasing the region's efficiency and resilience to economic crises. Innovation processes play an essential role in sustainable regional development, as well as in the progress of all countries that are part of a given region (Martin & Ottaviano, 2001). Innovations not only improve the economic performance of a region but also enable sustainable development based on knowledge and technology (Kijek et al., 2023). Therefore, it can be said that the ability to generate and apply new knowledge and innovations represents one of the key drivers of regional development. Regions that invest in research and development, support entrepreneurship, and create a favorable environment for innovation can achieve significant competitive advantages in the global economy.

The quality and success of innovations are crucial for enhancing competitiveness (Chursin et al., 2016). Competitiveness should also be supported by business sophistication in order to meet the demands of global competition. In an innovation-driven economy, business sophistication and innovation have bilateral impacts, as they are considered the main pillars of competitiveness. Business sophistication, which refers to the quality of business networks and the quality of operations and company strategies, is also one of the factors that promotes economic growth by improving efficiency, productivity, and profitability in the marketplace.
Joseph Schumpeter was one of the first scholars to use the concept of innovation in its modern sense in his research. As early as the beginning of the 20th century, he introduced a modern perspective on the notion of innovation. He argued that innovation should not be viewed merely as an invention or discovery, but rather as a transformative change through which these inventions can impact industry, the economy, and society as a whole. He introduced the concept of *creative destruction*, which describes how old industries are sometimes displaced by the emergence of new inventions—and that this is precisely the moment when economies experience significant and rapid advancement. He believed that true innovation occurs in waves or cycles. As early as 1911, he emphasized that innovation is not only about new products but also about finding more efficient ways of doing things (Schumpeter, 1911).

Schumpeter described innovation as “the fundamental driving force that keeps the capitalist engine in motion and stems from new consumers, new products, new methods of production, transportation, new markets, and new forms of industrial organization created by the enterprise” (Skawinska & Zalewski, 2009). He also argued that innovation is the source of economic change, claiming that economic development is driven by innovation through a dynamic process in which new technologies replace the old. In this context, he identified five types of innovation: the introduction of a new product, the introduction of a new method of production, the opening of a new market, the conquest of a new source of supply of raw materials or semi-finished goods, and the implementation of a new form of organization (Yang, 2006).

Not every idea or technical solution qualifies as an innovation, but rather as an invention (or discovery) that becomes an innovation through commercialization. An exceptional idea that represents a significant improvement but fails to achieve market validation and does not generate benefits for the market participant is not considered an innovation. Therefore, discovery is a relative concept, as the idea alone does not guarantee market success (Deakins &

Freel, 2012). History demonstrates a significant potential for the creation of new industries and the improvement of existing ones (Mauborgne & Kim, 2005). From this, it follows that an innovative organization is characterized by its ability to channel its creative efforts into useful outcomes. However, ideas that may develop into innovations do not originate solely within economic entities, nor are they only the result of market research or laboratory work.

According to Smith (2010), the sources of innovation can be individuals, corporations, users, employees, and external actors. In addition to facing numerous challenges on both the global and domestic markets, companies are also confronted with growing competition, while consumers are becoming increasingly demanding in terms of how their needs are met. This puts pressure on organizations and their ability to respond to these demands (Stamatović, Vukajlović & Cvetanović, 2016). This is yet another reason why innovative activity is required at all levels—from employees within organizations to national policy frameworks.
According to the classical theory of economic growth (Solow, 1957), productivity and economic growth depend on three factors that are inseparably linked to innovation. The central premise of this theory is that capital (capital investments) and labor (human resources) alone are insufficient to explain long-term economic growth. Rather, economic growth is primarily the result of technological progress.

In other words, long-term growth is achieved through increases in productivity, not merely through the expansion of production factors such as capital and labor. Solow developed a mathematical model that illustrates how technological progress accumulates over time and impacts the growth of gross domestic product (GDP). One of the key implications of his theory is the concept of convergence. The theory posits that societies with lower living standards tend to grow more rapidly in terms of GDP, while more developed societies grow at a slower pace. This is due to the fact that less developed societies are able to leverage the existing technology and experience of more advanced nations. While Solow's theory is significant and provides a fundamental framework for understanding the factors that influence long-term economic growth, later research and theories have taken into account more complex variables, such as education, innovation, and institutional frameworks.

When there is a lack of coordination between institutional activities and objectives within an economy, the result is often weak economic performance. This particularly refers to poor coordination among institutions within national innovation systems, which are simultaneously responsible for implementing macroeconomic policies and conducting innovation policy as a synthesis of scientific, technological, and industrial policies (Nasiff, 2007).
Economic entities, through their independent activities, cannot achieve significant innovation outcomes without government support and the intervention of regulatory and institutional frameworks that stimulate active innovation policies. The absence of adequate institutions (e.g., research capacities, equipment, etc.) can be partially mitigated by the actions of a modern state. Open questions surrounding inadequate national and international competitiveness increase the pressure on governments to intervene in the field of innovation. Therefore, active innovation policies are a common feature in both small and large emerging economies (Freeman & Lundvall, 1988). Despite the existence of numerous innovation incentives, there are also many barriers to innovation success. Innovation management often requires operating under conditions marked by ambiguity, uncertainty, and risk (Jančetović & Erić, 2012).

In some cases, years of effort toward improving a particular business process, product, or service may end in failure due to unforeseen circumstances, often accompanied by high costs

(e.g., lack of market acceptance, competition outpacing the innovation, or national and global market changes due to crises).

According to classical economic theory, countries should focus on producing goods in which they have an absolute advantage. However, Krugman's version of the theory emphasizes *comparative* advantage, meaning a country should specialize in the production of goods in which it is *relatively* more efficient, even if it does not have an absolute advantage. He also highlights that innovation and the development of new products can lead to increased product diversification within an economy. This is important because it enables countries to produce a broader range of goods, thereby becoming more competitive in global markets. Krugman is also well known for his research on the *geographical concentration* of economic activity, known as "agglomeration." According to his theory, firms often cluster in specific geographic locations to take advantage of proximity to other firms and skilled labor.
The integration of innovation, product diversification, comparative advantages, and agglomeration can boost a country's exports and contribute to its economic growth. All of this provides opportunities for companies in these countries to efficiently develop new products and industries, create jobs, and gain competitive advantages in international markets (Krugman, 1980).

3. Methodology

Measuring innovativeness is a key instrument for strategically guiding national economies toward innovation-driven growth models (Borocki, et al, 2013). A systematic assessment of innovation capacities enables the identification of comparative advantages and structural weaknesses of individual countries, providing a foundation for designing effective policies and mechanisms to foster innovation.

Given the multidimensional nature of innovation, its quantification requires the application of complex models based on a broad spectrum of parameters. Through this approach, global economies are ranked according to their level of innovativeness using various methodological frameworks and indicators published in annual reports (Tekić et al., 2012).

In this research, the authors analyzed official secondary data obtained from the Global Innovation Index (GII) reports for Southeast European countries (WIPO 2020-2024), classified according to the UNESCO methodology (UNESCO, 2025), for the period 2020–2024.

A comparative analysis of 14 Southeast European (SEE) countries and Switzerland, the world's top-ranked country, based on overall rankings and specific indicators, enabled the examination of dynamic changes in the region's innovation performance. The collected data were systematized and presented in both tabular and graphical formats, providing a clear basis for further analysis and interpretation of the key factors shaping the innovation potential of the observed countries.

4. GII Index

The Global Innovation Index (GII) is an annual ranking of countries based on their innovation capacity and performance, published by the World Intellectual Property Organization (WIPO). It was established in 2007 by INSEAD (Institut Européen d'Administration des Affaires – the

European Institute of Business Administration) and the British magazine *World Business*, and was conceptualized by Soumitra Dutta. The primary goal of the index is to provide a comprehensive overview of innovation within societies by identifying and developing relevant metrics and methodologies. Through this framework, the best- and worst-performing global economies are ranked based on their innovation capacities, offering insight into the strengths and weaknesses of national innovation policies and practices.

Conceptually, the GII ranking is based on two equally important sub-indices that together portray a complete picture of innovation: the Innovation Input Sub-Index and the Innovation Output Sub-Index. Each sub-index is structured around specific pillars—five input pillars and two output pillars.

The five input pillars are:

- Institutions
- Human capital and research
- Infrastructure
- Market sophistication
- Business sophistication

The two output pillars are:

- Knowledge and technology outputs
- Creative outputs

The input pillars capture elements of the national economy that enable innovation, while the output pillars reflect concrete evidence of innovation results. The GII is a key source of information for shaping innovation policy, although measuring innovation outcomes remains a highly complex task. The index focuses on assessing the environment and infrastructure for innovation, as well as evaluating the effects of innovation-related factors.

Although the final results of the GII include rankings, its core objective is to improve measurement methodologies, deepen the understanding of innovation, and identify targeted policy actions. Additionally, it promotes best practices and other initiatives that foster innovation. The extensive data provided by the GII—at the index, sub-index, and indicator levels—enable tracking of performance over time and comparisons with other economies in the same region. Particular emphasis in this work is placed on the WIPO annual reports for the period 2020–2024 (WIPO, 2020–2024).

5. Research results

This section presents the results of the comparative analysis of Southeast European countries based on the selected indicators from the Global Innovation Index (GII) over the period 2020–2024. The analysis focuses on three key pillars: Human Capital and Research, Business Sophistication, and Knowledge and Technology Outputs. These pillars were selected due to their strategic importance in shaping innovation capacities and driving regional economic development.

The results are organized in a way that allows for the identification of trends and performance dynamics within the observed period. The data are presented through comparative tables and are supplemented by Switzerland's performance as a benchmark country, providing additional

context to assess the innovation gap between the Southeast European countries and the world innovation leader.
By analyzing the changes in GII rankings over the five-year period, this section highlights both the progress and persistent challenges faced by the countries in the region, offering valuable insights for policy formulation and the design of targeted interventions aimed at strengthening the innovation ecosystem.

Table 1: Comparative Overview of Global Innovation Index rank - Southeast European Countries and Switzerland (2020-2024)

Country	2020	2021	2022	2023	2024
Albania	83	84	84	83	84
Bosnia and Herzegovina	74	75	70	77	80
Bulgaria	37	35	35	38	38
Montenegro	49	50	60	75	65
Croatia	41	42	42	44	43
Cyprus	29	28	27	28	27
Greece	43	47	44	42	45
Malta	27	27	21	25	29
Moldova	59	64	56	60	68
North Macedonia	57	59	66	54	58
Romania	46	48	49	47	48
Serbia	53	54	55	53	52
Slovenia	32	32	33	33	34
Turkey	51	41	37	39	37
SEE regional average	**49**	**49**	**49**	**49**	**49**
Switzerland	1	1	1	1	1

Source: WIPO (GII reports 2020-2024)

The data presented in *Table 1.* show the ranking of Southeast European countries according to the Global Innovation Index (GII) for the period 2020–2024. The best-ranked countries in the region throughout the observed period are Malta and Cyprus, with Cyprus maintaining a stable position around the 27th place, while Malta shows slight fluctuations but remains among the top 30 countries. Slovenia also holds a strong position, consistently ranking among the top 35 most innovative countries globally (32nd place in 2020 and 34th place in 2024).

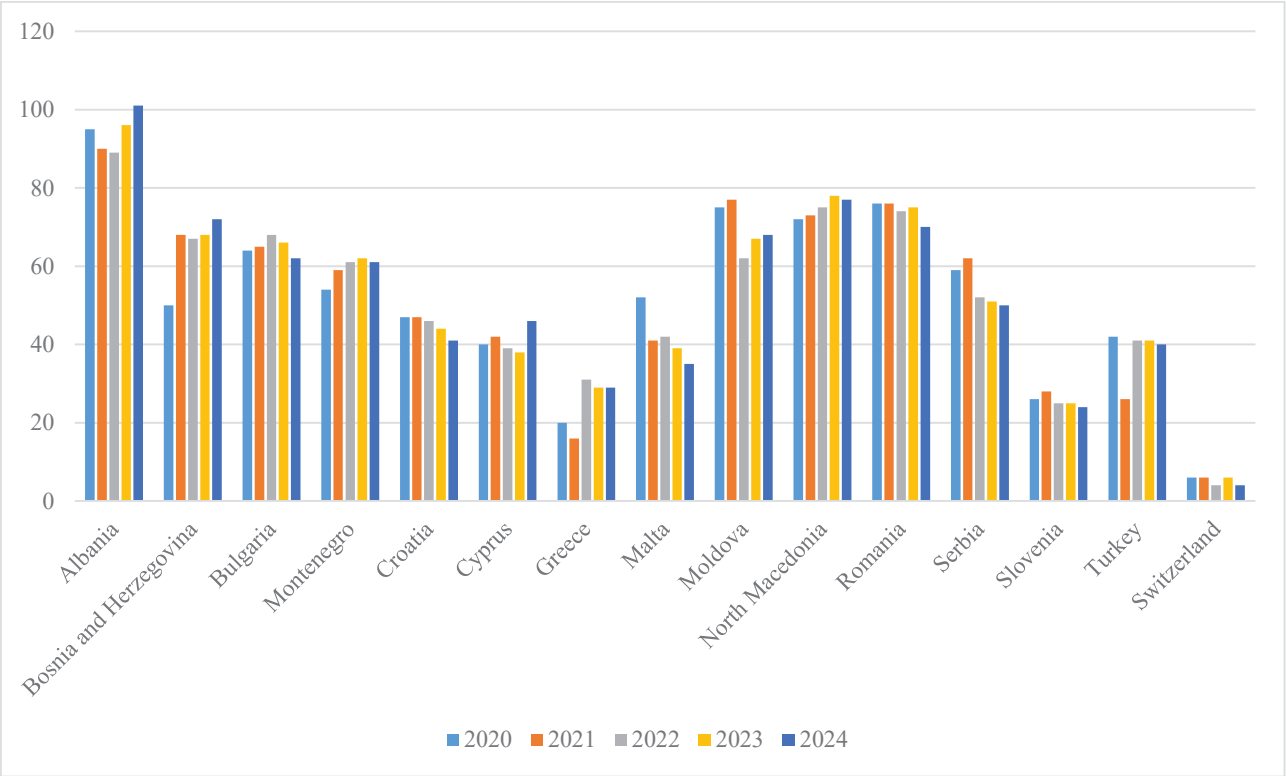
Greece and Bulgaria demonstrate solid but variable results, while Croatia and Romania maintain a stable mid-range position within the region. Turkey and Serbia show slight progress, while Moldova, Montenegro, North Macedonia, Bosnia and Herzegovina, and Albania remain below the regional average, with Albania consistently ranked among the lowest (84th place).
The average rank of Southeast European countries remains unchanged at 49th place throughout the observed period, indicating stagnation in comparison to global innovation trends. Switzerland, as the reference country, consistently holds the first position worldwide.

The key conclusion of this analysis is that significant differences in innovation capacities exist within the Southeast European region, with a few countries showing stable or slight improvement, while the majority experience stagnation or decline. These findings highlight the

need for additional investment in innovation, research, and development across the entire region.

Some of the most important factors and pillars influencing a country's innovation capacity and its position in the Global Innovation Index are Human Capital and Research, Business Sophistication, and Knowledge and Technology Outputs, which are the focus of the subsequent analysis.

Graph 1: Comparative overview of ranking values for the input pillar Human Capital and Research - Southeast European Countries and Switzerland (2020-2024)



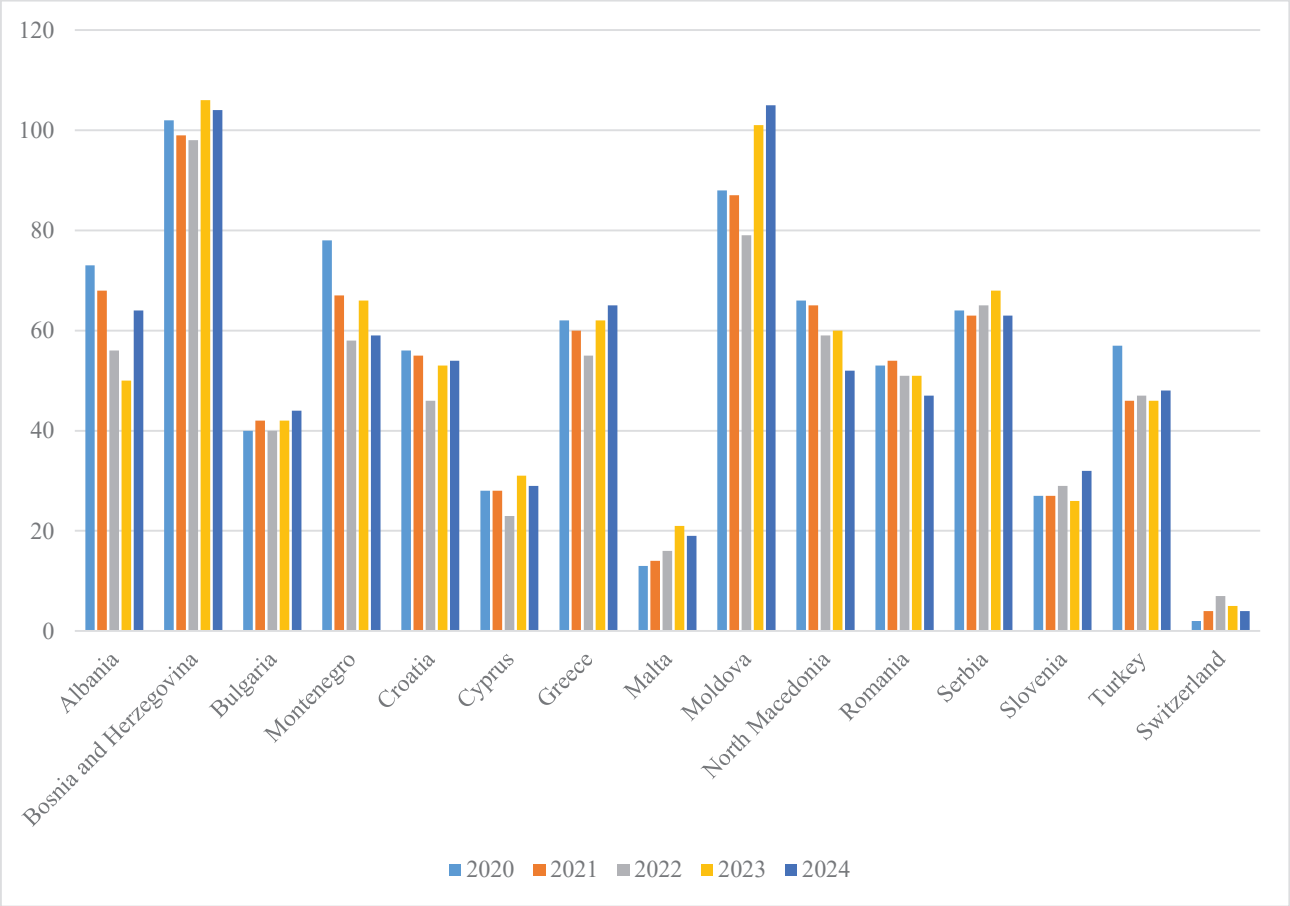
Source: WIPO (GII reports 2020-2024)

The data presented in *Graph 1.* show significant disparities among Southeast European countries in the area of Human Capital and Research. The average rank of Southeast European countries according to this indicator remains unchanged at 55th place throughout the observed period.

According to this innovation indicator, Slovenia and Greece lead the region, consistently ranking among the global top 30. Malta demonstrates one of the most positive trends, improving from 52nd to 35th place, while Cyprus and Croatia maintain stable or slightly improved positions. Serbia, Bulgaria, Montenegro, and Turkey occupy mid-range positions within the region, with slight fluctuations. Albania, Bosnia and Herzegovina, Moldova, North Macedonia, and Romania remain among the lowest-ranked countries, with Albania experiencing a continuous decline to 101st place in 2024. Switzerland, as the reference country, consistently ranks among the global top five in this pillar.

In conclusion, the region shows pronounced internal disparities, with a few countries recording progress, while most experience stagnation or decline, highlighting the need for increased investment in education and research.

Graph 2: Comparative overview of ranking values for the input pillar Business Sophistification - Southeast European Countries and Switzerland (2020-2024)



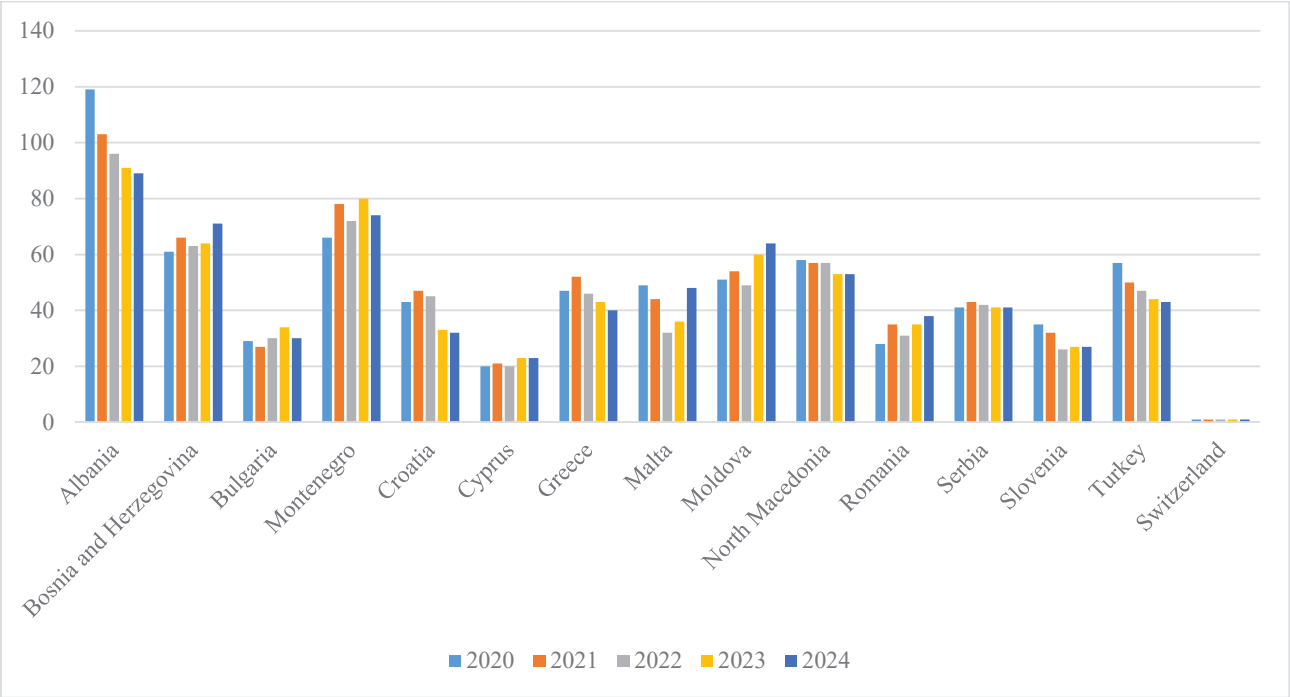
Source: WIPO (GII reports 2020-2024)

The results presented in *Graph 2.* indicate a significant gap among Southeast European countries in the area of Business Sophistication. The average rank of the SEE countries over the five-year period remains unchanged at 55 across all observed years.

Malta stands out as the most successful country, consistently maintaining positions among the global top 20. Cyprus and Slovenia also achieve strong performance, continuously ranking among the top 30 countries. In the mid-range are Bulgaria, Romania, Croatia, Greece, and Turkey, which hold stable but not substantially improved positions throughout the observed period. Serbia, North Macedonia, and Montenegro show slight progress but remain in the lower half of the regional ranking. At the bottom of the list are Bosnia and Herzegovina, Moldova, and Albania, with persistently weak results, indicating limited business sophistication and a lack of structural reforms in the business environment. As a global leader, Switzerland consistently ranks among the world's top five countries throughout the entire period, including in this important pillar of innovation.

The analysis of this indicator shows that only a small number of countries in the region demonstrate maturity and progress in business sophistication, while the majority continue to lag behind, highlighting the need to enhance corporate innovation capacity, support internationalization, and strengthen collaboration with the research sector.

Graph 3: Comparative overview of ranking values for the pillar Knowledge and Technology Outputs - Southeast European Countries and Switzerland (2020-2024)



Source: WIPO (GII reports 2020-2024)

The data from *Graph 3.* reveal significant disparities among Southeast European (SEE) countries in the area of Knowledge and Technology Outputs. The average rank for the region during the observed period is 49, indicating overall stagnation.

The best-performing countries throughout the entire period are Cyprus, Bulgaria, and Slovenia, which consistently rank among the top 30 countries globally. Croatia, Greece, and Malta maintain stable mid-range positions, with slight improvements observed for Croatia and Malta. Serbia, Turkey, and Romania achieve moderate results, showing stable but not significantly improved rankings over the period. Other countries, including Moldova, North Macedonia, Montenegro, Bosnia and Herzegovina, and particularly Albania, remain at the lower end of the rankings, with Albania consistently recording the weakest performance in the region. Switzerland, as the global leader in innovation, holds the first position throughout the entire observed period, reaffirming its exceptional strength in knowledge and technology outputs.
This analysis confirms pronounced internal disparities in the region's innovation capacities in the field of knowledge and technology. Only a few countries demonstrate stable or improving performance, while the majority remain below the regional and global average, emphasizing the need to strengthen knowledge transfer, technological development, and the commercialization of innovations.

The analysis of innovation performance among Southeast European countries for the period 2020–2024, across the indicators Human Capital and Research, Business Sophistication, and Knowledge and Technology Outputs, reveals an uneven and insufficiently dynamic pattern of development. Although Slovenia has positioned itself as the regional leader with stable rankings across all analyzed indicators, its progress remains modest. Cyprus, Malta, and Croatia demonstrate solid performance, while Serbia shows moderate growth, yet without a breakthrough into a higher level of innovation competitiveness.

Particularly concerning is the fact that the majority of countries, including Albania, Bosnia and Herzegovina, Moldova, and Montenegro, continue to struggle with structural weaknesses, such as insufficient investment in research and development, brain drain, and weak collaboration between science and industry.

In this context, Switzerland continues to serve as a global benchmark for innovation excellence, highlighting the critical role of systemic coordination between education, research, and industry in achieving sustainable innovation success. In contrast, most Southeast European countries still lack sufficiently developed institutional capacities and clearly defined strategies that would enable them to move from the phase of imitation to the phase of creating original knowledge and technological innovations.

6. Conclusions

This study examined the role of innovation metrics, with a particular focus on the Global Innovation Index (GII), in assessing the economic development of Southeast European (SEE) countries. The analysis confirmed the central thesis that innovation is a key driver of economic growth, productivity, competitiveness, and sustainable development, particularly in the context of an increasingly globalized and technologically advanced world.

The comparative analysis of SEE countries in relation to global leaders revealed significant heterogeneity in innovation performance across the region. Although some countries have achieved notable progress in certain innovation dimensions, primarily due to their higher levels of economic development, the region as a whole continues to lag behind global frontrunners. This innovation gap reflects missed opportunities for accelerated economic growth, the creation of high value-added jobs, and the strengthening of resilience to economic shocks, which are increasingly characteristic of modern market economies.

The research also identified key areas that require intensified reform efforts and investment. Priorities include improving innovation infrastructure, strengthening cooperation between academia and industry, and encouraging investment in research and development (R&D). Furthermore, the findings highlight the need for more effective and context-sensitive innovation policies that can significantly contribute to accelerating technological development, enhancing regional competitiveness, and reducing development disparities within the SEE region itself.
This study contributes to the existing body of literature by providing empirical insights into the innovation performance of the observed SEE countries, a region often underrepresented in international innovation research. The findings have significant practical implications for policymakers in terms of advancing and strengthening innovation, as well as for academia, the business sector, and other relevant stakeholders, offering concrete recommendations for enhancing innovation ecosystems and supporting sustainable economic development.

Future research should focus on a deeper analysis of specific institutional, cultural, and socio-economic factors that may hinder or foster innovation in SEE countries. This also represents one of the main limitation of this research. Additionally, longitudinal studies examining the long-term effects of innovation policies on economic performance could provide valuable insights for shaping more effective strategies for economic growth and development, as well as for innovation-driven transformation of the region, enabling it to effectively respond to future challenges and maintain its innovation competitiveness both within Europe and globally.

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REFERENCES

Borocki, J., Orcik, A. & Cvijic, M. (2013): ***Measuring Organizational Innovativeness.*** in Challenges for the Future – Engineering Management, Faculty of Technical Sciences (Novi Sad, Serbia), Fraunhofer IAO (Stuttgart, Germany) and DAAAM International (Vienna, Austria).

Chursin, A., Vlasov, Y., & Makarov, Y. (2016): ***Innovation as a Basis for Competitiveness***. Theory and practice, 1-336.

Deakins, D., & Freel, M. (2012): ***Entrepreneurship and small firms 6e***. McGraw hill.

Freeman, C., & Lundvall, B.-Å. (1988): ***Small Countries Facing the Technological Revolution,***in C. Freeman, & B.-Å. Lundvall,London: Frances Pinter.

Kijek, T., Kijek, A., & Matras-Bolibok, A. (2023): ***Innovation and regional development,***in Innovation and Regional Technological Convergence: Theory and Evidence (pp. 5-23). Cham: Springer International Publishing.

Krugman, P. R. (1980): ***Scale Economies, Product Differentiation, and the Pattern of Trade,*** The American Economic Review, 70(5), pp. 950-959.

Jančetović, M. & Erić, I. (2012): ***Menadžment inovacija***, in M. Jančetović, & I. Erić, Beograd: Beogradska poslovna škola.

Martin, P., & Ottaviano, G. I. (2001): ***Growth and agglomeration. International economic review,*** *42*(4), 947-968.

Mauborgne, R. A., & Kim, C. W. (2005): In R. A. Mauborgne, & C. W. Kim, ***Blue ocean strategyy - How to Create Uncontested Market Space and Make the Competition Irrelevant***, Boston: Harvard Business School Publishing.

Nasiff, A. (2007): ***National Innovation System And Macroeconomic Policies: Brazil And India In Comparative Perspective***, UNCTAD Discussion Papers (p. 184). United Nations Conference on Trade and Development.

Schumpeter, Joseph A. (1911): ***The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle,*** Translated by Redvers Opie, Harvard University Press, 1934. (Originally published in 1911).

Skawinska, E., & Zalewski, R. (2009): ***Impact of technological innovations on economic growth of nations***, Journal of Systemics Cybernetics and Informatics 2(6), 35-40.

Smith, D. (2010): ***Sources of innovation,*** in D. Smith, Exploring Innovation (pp. 73-89). Berkshire: McGraw Hill Education.

Solow, R. M. (1957): ***Technical Change and the Aggregate Production Function***, Review of Economics and Statistics, 312-320.

Stamatović, M., Vukajlović, Đ. & Cvetanović, S. (2016): ***Inovacije kao pokretački faktor razvoja privrede,*** Ekonomija: teorija i praksa, 9(1), 19-34.

Tekic, Z., Borocki, J. & Ćosić, I. (2012): ***O inovativnosti Srbije i regiona***, u Inovacije i preduzetništvo: alati za uspeh na tržištu EU, Beograd, Srbija: Fakultet za ekonomiju, finansije i administraciju, Univerzitet Singidunum, str. 15 - 31.

Trott P. (2005): ***Innovation management and new product development,*** London: Prentice Hall, 2005.

UNESCO (2025): ***Country Files for: South- East Europe,*** http://www.unesco.org/new/en/venice/about-this-office/where-we-work/southeasteurope/ (accessed 10 November 2024)

Yang, C.-H. (2006): ***Is innovation the story of Taiwans economic growth?,*** Journal of Asian Economics,17, 867-878.

WIPO (2020): ***The Global Innovation Index 2020: Who Will Finance Innovation?*** I SSN: 2263- 3693, https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020.pdf.(accesed 05 December 2024)

WIPO (2021): ***Global Innovation Index 2021: Tracking Innovation through the COVID- 19 Crisis.,*** DOI: 10.34667/tind.44315, https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021.pdf. (accessed 05 December 2025)

WIPO (2022): ***Global Innovation Index 2022: What is the future of innovation- driven growth?*** DOI: 10.34667/tind.46596, https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2022-en-main-report-global-innovation-index-2022-15th-edition.pdf.(accesed 05 December 2024)

WIPO (2023): ***Global Innovation Index 2023: Innovation in the face of uncertainty,*** DOI:10.34667/tind.48220, https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2023-en-main-report-global-innovation-index-2023-16th-edition.pdf. (accessed 09 December 2024)

WIPO (2024): ***World Intellectual Property Organization. Global Innovation Index 2024: Unlocking the Promise of Social Entrepreneurship***, DOI:10.34667/tind.50062, https://tind.wipo.int/record/50062/files/wipo- pub- 2000- 2024- en- global- innovation- index- 2024- 17th- edition.pdf. (09 December 2024)