

STARTUPS – BUSINESS MODELS FOR ENHANCING SUPPLY CHAIN 4.0

Slobodan Ćimović

Faculty of Economics, University in Belgrade, Serbia

E-mail: slobodan.acimovic@ekof.bg.ac.rs

Nenad Stajić

Faculty of Economics, University in Belgrade, Serbia

E-mail: nstajic@ekof.bg.ac.rs

Received: July 16, 2022

Received revised: September 14, 2022

Accepted for publishing: September 20, 2022

Abstract

Digitization within global supply chains has been on the firm forward pace since its early beginning in 2011. Supply chain members are now in position not only to learn about digitization, but to proactively plan and implement technological innovations in their business models. Value chains are being much more circular and more structured than ever so has been the urge for digital upgrade of the companies who are creating the value. Observing the drivers for digital acceleration, there is a need to understand the role of startups in everyday business conduct of supply chain members. Multinational companies (MNCs) are investing significant amounts of financial resources in order to achieve viable results from their R&D departments, but many of them are trying to add value through a more holistic approach: cooperation and/or acquisition of startups into the business. Logistics industry especially has become the “fertile” area for external drivers, such as logistics focused startups, to act and improve some of the key functions and processes within the companies. This paper aims to explore and confirm the positive connection between MNCs' drive for digital upgrade of their supply chains and cooperation with logistics focused startups in observed functional areas. Authors are focused to determine theoretical and practical business enhancement of supply chain 4.0 which has been based on cooperation with startups, by conducting literature review and by researching several related mini case studies.

Key words: supply chain, digitization, startups, industry 4.0

1. INTRODUCTION

Supply chains are considered as one of the most innovation related value chains around the globe in terms of industry development. Production, logistics, warehousing, transportation and retail have been among pioneers of adopting

innovative technological solutions. Industry 4.0 is “producing” a variety of technological innovations and many of them have been implemented in everyday business models of companies.

Digitization based on innovations 4.0 has been on “full steam” ahead since few years ago. Many multinational companies (MNCs) around the global supply chains, dedicated enlarged budgets to their R&D departments in order to generate additional value to their business models through digitization. Technological innovations such as Internet of things (IoT), blockchain, big data management, robots, augmented reality (AR), virtual reality (VR), autonomous vehicles are reshaping interconnection between business models of companies and added value through innovation.

Regarding the logistics and supply chain industry, there has been a variety of drivers for digitization of companies. One of the most common categories regarding drivers could be focused on two types of drivers: internal and external. Internal drivers, as the name states for itself, are drivers coming from within the company, such as: need for function and/or process improvement, adjusting business models, governance style, need for reshaping or improving organization culture etc. External drivers are drivers coming from business environment, such as: competition and market pressure, customer expectations, consumer behavior, governmental policies, etc.

Lately, with expansion of startup community and rise of entrepreneurial mindset of society (especially amongst millennials), innovators are transforming their inventions into small business endeavors. The result of these endeavors is possibility to sell their products or even whole businesses to MNCs.

The connection between startups which have been absorbed, merged or acquired by MNC, is exactly the main focus of this research. During the research, this two-side cooperation has been observed as a trend in business community, especially among supply chain members. The possibility to invest asset in acquiring startup within MNC in order to digitize and evolve the business has been considered as a driver for fast and qualitative supply chain digitization.

At the start, this paper is giving the insight on the Industry 4.0 technological impact on supply chain; afterwards, authors are giving the perspective on supply chain digitization drivers; at the end, cooperation between startups and MNCs has been focus of the analysis. The analysis ends with comparison of several mini case studies regarding the mentioned topic of the research and conclusion.

2. LITERATURE REVIEW

The research has been based on descriptive methods. Literature review of the most relevant and trending scientific articles, proceedings, analysis, databases and journals has been used to understand the treated topic relevance and contribution of other authors. At the end, several mini case studies are representing real business examples that confirm the theoretical findings.

Descriptive and explanatory methods are dominant in the paper. Literature review of scientific papers and conferences proceedings set the foundation for theoretical research on cooperation. Business, institutional publications and case

studies provide the insights of practical cooperation between startups and MNCs. Further, in person interviews and cross analysis of selected case studies focusses on selecting the results and conclusions on the topic of the research. The literature review has been based on exploring and selecting the most viable articles on online open access database of scientific publications, such as “Science Direct”, “Emerald Publishing”, “Wiley online library” and “Springer/Kluwer” and review of the conference proceedings, business databases, public business journals, publications, analyses and studies from institutions of importance to the topic of the research. Keywords for searching the appropriate sources included the following keywords: “supply chain digitization”, “supply chain startups”, “startup and logistics”, “logistics 4.0”, “startups and industry 4.0”, “supply chain digitization drivers” and “startups innovation”.

During the mentioned research, authors have managed to process 42 relevant literature sources. Out of 42 literature sources, the authors consider 28 sources to be of narrow relevance to the topic. The most significant findings related to the topic of the paper can be found in the following sources: 1. “Research on the impact of supply chain integration of startups: service supply chain perspective” (Lin & Lin, 2018), 2. “The digital supply chain of the future: from drivers to technologies and applications” (Pflaum et al., 2018), 3. “Engaging with startups: MNC perspectives” (Prashantham & Kumar, 2019), 4. “Startups in the supply chain ecosystem: an organizing framework and research opportunities” (Wagner, 2021), 5. “Engaging with startups to enhance corporate innovation” (Wieblen & Chesbrough, 2015), 6. “Startup funding in logistics: focused investment in a growth industry” (McKinsey and Company, 2022).

Other than science paper research and review, authors have conducted secondary research on startup integration by examining available business information regarding the topic. The main issue with literature review on the topic of startup - MNC integration is limited amount of available online studies within mentioned scientific database. Authors have had to understand what is the difference between the startup acquisition process in MNC compared to the traditional processes of integrating one company into another.

Mini case studies analysis based on online research of available startup – logistics/supply chain 4.0 cases. The research was conducted by typing the following keywords into “Google.com” search bar: “logistics startups”, “supply chain startups”, “Amazon and startups”, “MNC and startups”, “startups 4.0 case study” and “startups and MNCs cooperation”. The range of selected case studies for paper research estimated from 5-10, but only 3 of them were selected for analysis. Authors have picked: Maersk – Huub integration, Bosch – Five integration, Shopify – Deliverr integration regarding the topic relevance, paper context and theoretical findings.

3. THE IMPACT OF INDUSTRY 4.0 TECHNOLOGIES ON SUPPLY CHAIN DIGITIZATION

Since 2011. when the term - Industry 4.0 – was introduced at Germany’s National Academy of Science and Engineering (Kurt, 2019), digitization of business became one of the most important aspect of maintaining critical competitive

advantage on the market. The predictions made regarding rapidly transforming business models in supply chain are proving to be correct (Schrauf & Bertram, 2016). Invented technologies managed to set themselves as a necessity for improving business performances in observed period of time.

The course of rapid transformation motivated researchers to even define the concept of digitized supply chain. One of the most appropriate definition of digital supply chain (DSC) describes the supply chain as a value-motivated and efficient process for generation of new forms of production value for organizations, as well as for finding new approaches to technology and analytical methods applicable to the supply chain (Büyükoçkan & Fethullah, 2018). The definition refers to transformation model which ought to replace traditional functions and processes in order to gain maximum results by using modern technologies.

Advances in digital technologies are extensive especially in managing of supply chains (Sang & Trimi, 2021). The connection between invented technologies 4.0 and possibilities for technology implementation within companies has always been tight. Leading technologies with significant impact on transforming supply chain business such as Internet of things (IoT), blockchain, big data management, robots, drones (UAV), augmented reality (AR), virtual reality (VR), autonomous vehicles have already been in continuous everyday flow of work. Many authors through their papers are presenting that most important impact from technology 4.0 lies in rise of the level of transparency, speed, communication, collaboration, flexibility and responsiveness, which was systematically analyzed in the paper “Digital supply chain - leading technologies and their impact on industry 4.0” (Aćimović & Stajić, 2019).

After more than a decade of innovation 4.0-based growth, MNCs are no longer bringing in question opportunities coming from possible use of technologies 4.0. However, there are several more questions for decision makers, such as: 1. determination and necessity regarding the transformation of sector, function, process, product or service, 2. internal or external innovation process, 3. technology adaptability. First and second question are actually referring to driving forces for digital transformation. Decision makers need to understand company’s necessity for digitization and to point out transformation motive. They have to determine whether they have inner drive for change or outer pressure for adapting new market/consumer expectations. The following step is to evaluate options for bearer of conducting the transformation (decision on possibility for internal innovation process or implementation of external innovative technology). Drivers for change often define whether the company need to change its business model.

4. SUPPLY CHAIN DIGITIZATION DRIVERS

Regarding the analysis and determination of supply chain digitization drivers, the first and foremost task is to discover the relatable source of necessity for digitization. It has been broadly accepted that drivers are derived from necessities. The foundation for determination of drivers could be found in operational business problems (Accorsi et al., 2018; Gunasekaran et al., 2018), a change in business strategy models (Hainen et al, 2018) and business environment factors. These

enumerated elements are foundation for generating and structuring drivers (internal – external drivers) for supply chain digitization which is shown in Table 1.

Table 1. Certain supply chain digitization drivers (internal and external) derived from the base change necessities

Necessity for change	Examples	Driver (Internal/External)
Operational problems	<ul style="list-style-type: none"> • Warehouse pallets manipulating • Last mile delivery options • Big data management • Transportation and utilities cost • Raw materials origin tracking ... 	Internal
Change in strategic business models	<ul style="list-style-type: none"> • Cost reduction • New product/service • Adaption of current product/service portfolio • Investment cycle • Supply chain reconfiguration ... 	Internal - External
Business environment factors	<ul style="list-style-type: none"> • Competition “innovation pressure” • Consumer expectations • Market adjustments to new technological trends • Public and governmental policies • Advanced business models (i.e. startups) ... 	External

Source: Authors

Table 1. represents structured example of certain digitization drivers which are derived from determined necessities for change. The drivers are structured as internal and external as most common comparison model. They are also structured as internal and external to cover the topic of paper being addressed. Operational problems, strategic business models and business environment factors are set as fundamental detected areas for improvement of company. Further, several examples are given to specify the unique activities within the detected area for improvement. All together are resulted as the internal or external driver for supply chain digitization.

Business environment factors have been strong external driver for company digitization. Discovering new possibilities regarding digital technologies resulted with several different market behaviors such as: 1. competition pressure regarding business model innovation; 2. change in consumer expectations especially in terms of product/service customization and delivery time; 3. adjusting policies and regulations of business conduct on local, regional or national level; 4. raising of entrepreneurial behavior in order to turn technological advantages in profits; etc.

If startups have shown a successful business indicator, they are fertile area for MNCs to integrate them in everyday business.

5. INTEGRATION OF STARTUPS IN ORDER TO ENHANCE DIGITIZATION

Startups and MNCs are tightening their cooperation in order to deliver innovative product or service on the market. Certain MNCs are finding more interest in investing or even acquiring in startups in comparison to cost of internal innovation development. Logistics and supply chain startups are tackling many supply chain areas such as: last mile delivery, road freight and marketplace solutions, visibility and transparency, inventory and warehousing, etc., so many MNCs are always “on the market” searching for best option for external business development. In several further second level titles, authors are focusing on structural topics regarding integration of startups into MNC.

5.1. MNC’s motivation for cooperation with startups

Startups are associated with innovation, emerging technologies, high reward – failure risk, fast business scaling and global impact (Wagner, 2021). Startups are based on innovative business models which are mostly or fully digitized. They are strictly oriented on solving business problems which are highly challenging and based on different value proposition. The main characteristics of startup is to resolve business problem through technological implication. Owners are often oriented on fast (up to couple of years) developing of the startup and selling it afterwards in order to obtain high level of buyouts. Logistics industry, sometimes wrongfully considered as a not so innovative and dynamic in terms of developing innovations, has been on a prime impact from new technological advancements. Entrepreneurs realized that logistics 4.0 could be fertile area for raising logistics startups. They have discovered that almost every new 4.0 technology advancement could be implemented in some form of profitable startup entity. That entity could be later sold to MNC or venture capital investor. Some authors are considering that MNCs have realized that startup’s open innovation to commercially exploit profitable inventions, will successfully manage external knowledge into their business models (Del Sarto et al., 2022).

The inside report issued by World Economic Forum states that „due to the variety of digital technologies and their embedded complexities, it is difficult – if not impossible – for companies to possess knowledge about all opportunities enabled by digital technologies” (World Economic Forum, 2018). MNCs are facing several key decisions regarding particular digitization alternatives. Among others, they need to evaluate risks regarding internal innovation development and external drivers such as possibility for startup integration as well (Prashantham & Kumar, 2019).

MNCs are conducting financial cost-benefit analysis in order to determine whether or not the internal innovation development is most viable option. Key assessment factors are: strategic orientation towards innovation, level of expenses regarding internal digitization, know-how, knowledge regarding technology

implementation, available support services, potential additional educated and skilled workforce, duration of investment cycle, internal infrastructure bottlenecks, patent policies etc. MNCs are weighing the amount of time and financial resources in comparison with overall cost of possible external integration. In many cases, digitization based on external integration has been more viable, because after the integration, company's task is to acquire knowledge, assimilate it, then transform the new technologies within the current functions and processes and exploit the technologies to improve their performances (Trantopoulos et. al., 2017) which has been resonated as less expensive way.

MNCs are trying to minimize direct and indirect cost of digitization (Bogodistov & Ostern, 2019). Direct costs of digitization, i.e. implementation of pallet robot in warehouse, and indirect costs of digitization, i.e. training costs for warehouse workers, could be a threat for cost management and successful digitization. As mentioned above, cost – benefit analysis more often shows that internal innovation could be both time and cost consuming.

Intellectual property (IP) rights for product/service invented in supply chain startup, but also designs and trademarks can become a point of interest for a MNC to explore possibilities for cooperation. Eventhough, startup founders are trying to save the rights on patent, in order to make an integration, large corporations are requiring that all IP patents, documents and similar are being transferred to MNC (Weiblen & Chesbrough, 2015). In order to freely and properly manage digitization within company, many corporations are very persuasive in terms of the IP transfer.

Corporations identify startups as organizations with business models based on „lean methodology“. Those models are ensuring MNCs that startup pay full attention to: creating unique value for customer, produce only what is important for customer, identify value stream, create flow, pursue perfection (Ghezzi & Cavallo, 2020). Once MNC finds matching startup, it is ensured that mentioned methodology has been completely followed.

As a stand perspective of a startup as a customer, MNCs are indifferent toward cooperation. They realise that partial benefit from mentioned cooperation could be conduct through creating new sales channels and customized deversification (Bjorgum et.al, 2021). In another words, the MNCs would gain several new rather small customer channels.

As from a stand perspective of a startup as a supplier, MNCs are little bit more interested in supply chain startups. Potentials for customized product/services, additional small-size supplier network, flexibility, organizational agility etc are something which will bring attention to possible cooperation (Wouters et al., 2018). But, according to Ketchen and Craighead (2021) and their recently introduced concept of „supply chain entrepreneurial embeddedness“ (SCEE), the more detailed integrated cooperation through joint cooperation in business ventures affects the growth of business capacities of both entities.

Integration is the topic especially interesting to MNCs when necessity for digitization meets appropriate external candidate. Mature startups are representing optimal candidates for integration and digitization development. There are several phases of maturity of startup company, but overall phase which describes startup integration readiness is „born global startup“ (Lotti Oliva, et al., 2022). Born global

startups are typically young - led, entrepreneurial, small entities characterized by limited resources. Despite this restriction, they undertake international business from the initial stage of their development and gaining profits from several different countries. They are „big players” market oriented and competing with some of the biggest companies in the industry.

Rapid expansion in terms of market share and employees rate is also key indicator that startup can be considered for integration.

When supply chain startup is aligned with these indicators, MNCs are usually open for negotiation and integration.

5.2. The options for integration of startup by incumbent MNC

Fourth industrial revolution implicates necessity for MNCs to review their traditional business models. Academia still doesn't have a completely sure answer regarding the scope of digitization change for future business conduct of MNC. There is still an argument that digitization should present overall change in corporate culture. On the other side, certain authors are representing the idea that only new functions and/or departments, such as Innovation department, should be basic carrier of development, rather than transforming entire organization. The vision of decision makers and business capacities are defining the level and scope of digitization.

After thorough cost-benefit analysis, the MNCs are making the decision regarding the options for integration. According to study conducted by EY in 2021, one of the largest audit-consulting company in the world, depending on scope and business capacities, MNCs are open for:

1. preservation model (similar goals, targets, business conduct, etc with minor integration level), 2. symbiosis model (similar goals, similar targets, aligned strategy, brand acquisition, partial functional digitization, major integration) and 3. absorption model (full scope acquisition).

More regarding options for integration in Table 2.

Table 2. Characteristics, benefits and digitization outcomes from different option of startup integration by multinational company

	Preservation	Symbiosis	Absorption
Integration level	Run acquired startup almost as separate business.	Selective integration of certain elements of business model.	Full integration of startup into MNC.
Characteristics	Statutory alignment, small wins (such as cross-sales); existing functions with minimal digitization changes.	Overhead and back office functions integration; functions synergy (e.g. sales, R&D); partnership model for some activities.	Corporate and administrative functions consolidation; integration of strategy and operations and tools, core

			functions integrations.
Benefits	Retains existing culture, transaction speed, minimum business disruption	Common value drivers derived from partial integration; cost – efficient synergetic effects.	Full synergy effects; full scope of digitization.
Digitization outcomes	Low level of digitization, certain transformation of processes.	Middle to high digitization transformation of functions and processes.	Full level of business model or function and/or processes.

Source: adapted from https://www.ey.com/en_ch/strategy-transactions/how-do-you-integrate-startups, [access June 10, 2022]

Table 2 represents an overview of the possible level of integration and the outcome of digitization in terms of the vision and business capacity of the existing company. The level of integration is correlated with the expected level of transformation and achieved benefits from digitization. It is believed that with each higher level of integration, starting from the level of "preservation" and ending with the level of "absorption", there is a higher realization of synergistic effects and thus an increase in the level of transformation of the process. A harmonized vision of the company's digitization, business capacities and the level of desired integration directly determines the quality and scope of the MNC's business transformation.

Digital transformation through the integration of an external driver (startup) affects the entire industry, especially the areas of logistics and/or retail. In these sectors, existing traditional business models are largely being challenged by organizations coming from the startup community. Large supermarket chains, megastores and ecommerce often receive signals from the market that a digital change of certain functions and/or processes is needed, both through competitive activities and through their own research.

New organizations using technologies such as virtual reality, large database management, etc. to create the possibility of reacting and repositioning members in the supply chain in an increasingly digitized business environment (Pflaum et. al., 2019).

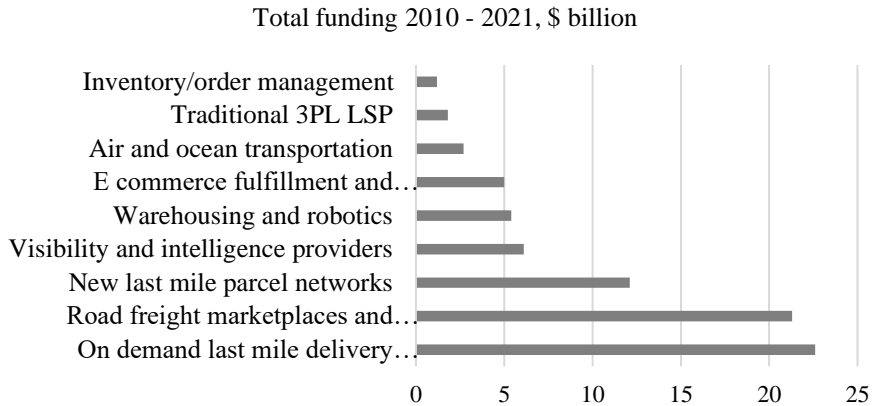
5.3. Supply chain startups – most common areas for innovations

As early mentioned, logistics startups are mostly tackling several key challenges within supply chains, such as: last mile delivery, road freight and marketplace solutions, visibility and transparency, inventory and warehousing, etc.

In order to understand most common segments of supply chain which have been tackled by startups, McKinsey and Company conducted survey and a secondary type of research, within over 500 companies in 18 countries in 2022. Data showed that more than several tens of billions of dollars has been invested in span of 11 years.

The survey is based on total funding into supply chain startups from 2010 – 2021. in 9 business segments of supply chain which has been shown on Figure 1.

Figure 1. Startup business models (9) challenging the traditional supply chain industry



Source: adapted from <https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/startup-funding-in-logistics-focused-investment-in-a-growing-industry>, [access June 15, 2022]

Figure 1 is a representative view of the current state of financial investment in startups dealing with the specified supply chain segments and a realistic indicator of the amount of funds invested in the industry. McKinsey and Company, during its research, determined that the data from Figure 1 shows that only in these 9 categories, in the observed period, more than 80 billion dollars were invested in the development of innovative business models in the supply chain. The table indicates that over 40 billion dollars have been invested in startups with the aim of solving problems in last mile delivery and road transport. The rest of the nearly \$40 billion is split into a number of other categories (warehousing, robotics, e-commerce, air freight, inventory, etc.). Such a structural distribution also indicates in which segments there are the greatest challenges and needs for digitalization, as well as the need to invest multi-million capital in terms of digital development of the segment. Figure 1 provides an overview of how large the startup market is for the organizations within supply chain improvement area.

Considering the mentioned segments and the amount of funds invested in the development of such startups, Table 3 shows an example of several global startups that deal with business development in the field of supply chain management, and whose estimated value is over 1 billion dollars.

Table 3. Certain supply chain management startups valued at more than \$1 billion

Startup name	Website	Business model	Estimated value
Flexport	flexport.com	A platform for ordering products and monitoring procurement. Organization of the entire supply chain.	\$3.2B
Exotec	exotec.com	They create robotic systems that manage inventory and storage through integrated hardware and software solutions.	\$2B
Deliverr	deliverr.com	An online platform based on machine learning for 3PL providers that connect to deliver products to the consumer within 1-2 days.	\$2B
Lalamove	lalamove.com	A mobile application that allows ordering, loading, transportation, delivery and similar functions in real time.	\$10B
Relex Solutions	relexsolutions.com	They use machine learning to understand the impact of hundreds of demand drivers for highly accurate demand forecasting, improving planning processes in merchandising and operations that impact better visibility into future demand.	\$5.7B
Convoy	convoy.com	A platform that uses artificial intelligence to improve road transport that emits almost 0% CO ₂ .	\$2.7B
Loadsmart	loadsmart.com	A platform that represents an engine that uses big data for automated assignment of loading, transportation, etc.	\$1.3B
Stord	stord.com	They provide efficient storage and distribution. They use 4.0 technology (AI, machine learning and cloud platforms) to connect a network of independent warehouse 3PL providers that manage the ordered products of consumers.	\$1.13B

Source: Authors

The selected examples of startups in Table 3 are showing the actual impact of the startup industry on the supply chain. Their business models, are solving everyday challenges in almost all segments within the chain, represent realistic options for the digitization needs of MNCs. Such, but also similar somewhat less developed startup models represent mature startup models that are ready for some of the MNC integration models.

5.4. Integration of startups to digitize MNC supply chain

Innovative organizational forms, such as startups, manage to position themselves as a relevant factor in Industry 4.0, which through their action can influence the faster and more efficient digitization of the process, function or business model of a traditional MNC (Silva & Sehnem, 2022). The external form of driver of digitalization of a company, as stated in the previous chapters, due to the possibility of low transaction costs and the speed of assimilation in MNC, manages to win over a larger part of decision makers in MNC compared to the possibility of internal research and development. Especially in the supply chain domain, technological innovations incorporated into the startup's core business show significant results. Therefore, startups as initiators of digitalization of the supply chain definitely have their role in the traditionally innovative-rigid members of the chain.

As the integration procedure itself has not been sufficiently covered in academic circles, the authors conducted a series of data and information analysis based on available business documents. Given the above, the conclusion is that cooperation between MNCs and startups starts from the first phase, which can include: a. identification of the need for digital transformation or b. a signal from the market environment that indicates an external solution that is applicable in the MNC (Valsalidis, 2020). It is the signal that comes from the market and indicates to decision makers the possibility of digitizing a part or area of business through a certain type of integration of an external entity, which is perceived as an external driver for digitization. As explained in part 4, external initiators, among others, can be startups that, by their actions on the market, represent a signal for MNCs that there is a possibility of digital transformation of business through a specific integration model. The second phase refers to the identification of the necessary processes or functions for digitization with the targeted startup model on the market. In the third phase (which is often called the matching phase), negotiations with the targeted startup are begun and initial tests are carried out in order to align the positive connection between the need for transformation and the offered options for cooperation (through the use of the product/service, through the beta testing period, etc.). If the conditions for technical cooperation are finally enabled, next is due diligence phase, i.e. with an assessment of the startup's business capacity. After the assessment phase is completed, the initial offer phase begins, as well as the finalization of negotiations. The final phase includes the buying and selling process itself, as well as the implementation of integration into regular business flows (e.g. the application of robotics solutions in the warehouse, application of a platform for managing big data in road transport, connection to the cloud platform of existing ERP systems, the use of blockchain technology in monitoring the originality of the procurement of raw materials, etc.).

Further, depending on the integration option specified in section 5.2. the "domestication" and implementation in the MNC is carried out, both of the technology, as well as of the possible workforce and other resources that the startup "brings in" with the integration.

During discussions research, it was learned that the levels of integration "preservation" and "symbiosis" are more common forms of partial integration (purchases of products/services from startups, transfer of IP, transfer of know-how of the startup sector, purchase of technology and integration of engineers, integration of the business model through the formation of a separate unit of the company, etc.). Companies want to improve performance in warehouse inventory manipulation, data processing in the procurement process, matching supply and demand in the chain, or they want to improve existing work systems. The level of integration "absorption", which includes the complete acquisition of startups by MNCs, is most often perceived as „eliminating competition”, but there are certainly cases where the motives of the entire integration are open, true and oriented towards a real need.

In the continuation of the paper, mini case studies are presented that practically demonstrate closer cooperation between multinational companies and startups. Those cases point to cooperation and achieved levels of integration, whose essential purpose is - digital transformation.

6. PRACTICAL RESULTS OF MNC - STARTUP COOPERATION IN THE FIELD OF SUPPLY CHAIN - MINI CASE STUDIES

The way of cooperation and the results achieved through integration are best described through real case studies that are related to the topic of the paper. 3 mini-studies are given below and their goal is to show how startups influenced MNCs to actively accepting technological solutions from the startup community that will influence the increase in the level of digitization of MNCs. The case studies are: 1. MAERSK - HUUB integration, BOSCH - FIVE integration, SHOPIFY - DELIVERR integration. Finally, Table 4 will show a cross-overview of the characteristics of these 3 mini-cases.

6.1. MAERSK – HUUB integration

Maersk is a Danish multinational integrated shipping company, active in ocean and inland cargo transport and related services, such as supply chain management and port operations. Maersk Growth is the company's corporate venture that invests in startup companies and partners to digitize and decarbonize logistics with them.

HUUB is a Portuguese startup company, specialized in B2C storage technology solutions for the fashion industry.

Maersk had the intention to digitize its omnichannel sales through internal or external development forces. Technological logistics startup HUUB offered a cloud-based solution on the market that would make it much easier for Maersk's customers

to focus on their core business of producing and selling goods and to quickly bring them to end consumers.

By researching the market back in 2018, the company made a decision to invest certain resources in the startup, so in 2019 it invested 1.9 million dollars in exchange for part of the equity capital. Through further assessment of business capacities, and after the negotiation phase, Maersk made a decision that the best solution for the current demand for digitization of sales channel management is the acquisition of the aforementioned startup in which they already have confidence and insight into the business model. The acquisition and integration were carried out in 2021, the details of the transaction were not disclosed, but both organizations gave a joint notice that the value of the acquisition was several hundreds of millions of dollars. The company has acquired an operations team that works together with engineers at Maersk, while the rest of the teams are partially or completely untransferred to the domicile company.

The specific digitization of part of the business model of this MNC related to the entire management system of key service operations, and this cloud solution covers all the basics of logistics operations, such as inventory, fulfillment and delivery, while the system is simultaneously connected to other business parties such as warehouses, carriers, online stores and enterprise resource planning (ERP) systems.

6.2. BOSCH – FIVE integration

Bosch is a German multinational company. It is one of the leading companies in the world in the production of electronics, home appliances and car parts. It also deals with engineering and development of safe systems in thermotechnology.

Five is a British startup company that primarily focuses on a platform for developing and testing software used in self-driving cars - autonomous vehicles (AV). Five has built a team of experts in cloud software, security, robotics and machine learning, and has positioned itself at the forefront of the development of software and AI-based solutions for autonomous driving in Europe.

The Bosch company intended with further refine of its software model in the field of the automotive industry in the segment of autonomous vehicle management. Working on the development of this model, the company saw the possibility to transform the existing solutions obtained from their R&D department in a faster and more optimal way through the integration of an external partner. With that, Bosch and Five integrated in 2022 and offered one of the most secure software solutions in this field on the market. Bosch retained the entire team that worked at the startup and fully completed the acquisition, and the startup became part of the Cross-Domain Computing Solutions Division.

The concrete digitization of the business model was reflected in the acceptance of a completely new 4.0 technological solution. The platform is able to analyze real data from a fleet of test vehicles, create advanced test scenarios and build a simulation environment that enables the evaluation and validation of system behavior at hyper-scale. In this way, the company used the digitization process

through a new technological solution to present a new product on the market and thus remain at the forefront of the competitive race.

6.3. SHOPIFY – DELIVERR integration

Shopify is a Canadian multinational e-commerce company headquartered in Ottawa, Canada. It is also the name of their e-commerce platform for online sales and retail outlet system.

Deliverr is a startup company based in California. By using predictive analytics and machine learning, Deliverr, which rents warehouse space and uses warehouse fulfillment departments to pick and pack e-commerce orders, predicts demand for products based on geography and other variables.

Shopify wanted to establish a complete express delivery system that was integrated with the existing solution, but also to completely transform the system in terms of the technology it uses. Their final goal was the complete automation of the end-to-end logistics service, and they found that kind of service externally, in the startup market - precisely in Deliverr. The acquisition and integration took place in 2022, and Shopify paid about 80% of the purchase in cash (almost \$1.68 billion), while about 20% of the company, or \$420 million, is in stock, totaling \$2.1 billion. Deliverr, along with some previous acquisitions, currently represents a single organizational logistics unit that reports directly to the company's CEO.

The concrete transformation that took place after this acquisition has been reflected in the „rounded logistics unit“, which, with machine learning, completely rounds off the end-to-end logistics service for the consumer. By integrating this startup, the company completely changed the previous system of operational and auxiliary work in the logistics sector.

6.4. Mini case studies comparison

Table 4. Comparison of the mentioned case studies - integration of startups in MNCs

MNC	Startup	Problem	Transformation areas	Dominant technology 4.0	Integration options	Transformation outcomes
Maersk	HUUB	Key service logistics operations	Logistics operations.	Cloud platform, big data management.	Symbiosis	High medium level of transformation.
Bosch	Five	A software product for the advancement of an autonomous vehicle.	Sales services.	Cloud platform, robotics, machine learning.	Symbiosis	Medium level of transformation

Shopify	Deliverr	Complete logistics service.	Logistics operations.	Machine learning, predictive analytics.	Absorption	Complete transformation.
---------	----------	-----------------------------	-----------------------	---	------------	--------------------------

Source: Authors

Table 4 represents comparison model of startup integration into MNC and its dominant characteristics derived from integration: key transformation, integration options and transformation outcomes. It shows that there are several levels of transformation outcomes considering the key problem in traditional sector and leading technology 4.0. Also, previous mentioned models of integration options are defined by level of digitization necessity within MNC. MNCs are looking for leading technologies 4.0 in order to achieve partial or full scope of transformation.

7. CONCLUSION

With the development of innovative technologies, with a special focus on the current Industry 4.0, a trend of intensive digitization of processes, functions and partial or complete business models has been observed. Multinational companies represent traditional business models, but at the same time pioneers in the adoption of innovations and the transfer of adopted know-how on a global level. In order to maintain and improve their competitive positions on global markets, MNCs are continuously researching and implementing all technological innovations that reduce costs and improve business segments.

In today's global business, the impact of technological innovations is visible in almost every business segment. New technological solutions, such as blockchain technology, AI, VR, AR, big data analysis, autonomous vehicles (AV), robotics, machine learning, and the like manage to change both functional units of business and entire business models. Looking at the supply chain, which has proven to be a business segment that is among the leading segments in terms of innovation absorption, these changes are extremely visible. In the relatively short observed period (from 2011 until now), the supply chain has taken on and defined a new dimension of chain management - the digital supply chain, which is a kind of proof of the aforementioned pioneering role in the implementation and use of new technologies.

The drivers of digitalization of MNCs, among others, are most often perceived and linked to the company's needs. Therefore, this paper presents the drivers that come "inside" the company and the drivers that act "outside". External - external drivers play an important role in the digitalization of the company and related activities in the supply chain. Among the aforementioned drivers, innovative business models stand out, i.e. startups that, through their actions on the market, are positioned as a relevant model that MNCs can "use" in order to achieve a quality business transformation. MNCs have positive preferences regarding cooperation with startups because by integrating them, they avoid high transactional, direct and indirect costs of internal business transformation, but also introduce new technologies, new knowledge and new innovative business models into their traditional management

model. Depending on the level of integration, some MNCs change their business models from the level of "preserving" their own business culture to the level of completely changing segments or the entire business ("absorption" of startups). Companies are finding significant interest in integrating startups that digitize their supply chains, especially in areas such as last mile delivery, integrated logistics operations management, road transport solutions, supply and demand matching platforms, warehouse operations management, inventory management, advanced analytics management, etc. Mature startups can be worth hundreds or even billions of dollars and their business models are developed to an optimal extent that serves MNCs to more easily integrate these organizational models and thus accelerate digitization. The acquisition and integration of startups in MNCs is not too different from the acquisition of traditional companies in MNCs, but it is fundamentally different in terms of changing the way of conducting operations and accepting or rejecting a new business culture. Depending on the level of integration also depends on the level of transformation of the company, i.e. transformation of the supply chain in the observed case. The mentioned mini case studies show and prove real business examples that took place in the last two years, and were implemented by leading companies in their business fields: Maersk - global shipping, Bosch - global manufacturer, Shopify - global e-commerce provider. These companies showed that rapid transformation could lead to increase performances in: last mile delivery, data management, cost reduction, human error redundancy etc.

Startups influence the initiation of digitization of a process, function, part or the entire business of an MNC and have the potential to significantly influence the transformation of the MNC's business.

Limitations to the paper are referred to narrow range of available literature with the focus on deep startup – MNC integration. There is an opportunity for deeper primary research in order to completely understand integration process. Another limitation is referred to integration effects. The both sides, startups and MNCs, are providing minimal data regarding financial effects of the integration. After-integration data is crucial for understanding critical financial aspects of digitization.

Related to limitations, further research could be more focused on deeper analysis on financial aspects of after-integration proces.

8. REFERENCES

Accorsi, R., Cholette, S., Manzini, R., Tufano, A., (2018). A hierarchical data architecture for sustainable food supply chain management and planning. *J. Clean. Prod.* 203, pp. 1039–1054.

Aćimović, S., Stajić, N. (2019). Digital supply chain - leading technologies and their impact on Industry 4.0, *Business logistics in modern management 19*, Osijek Croatia, October 2019, University of Osijek Faculty of Economics, pp. 75-90.

Bjørgum, Ø., Aaboen, L. and Fredriksson, A. (2021). "Low power, high ambitions: new ventures developing their first supply chains", *Journal of Purchasing & Supply Management*, Vol. 27, pp. 1-10.

Bogodistov, Y., Ostern, N. (2019). Digitization at any cost? Willingness to trade efficiency for organizational, human and relational costs, Organizational, transformation and information systems (sigorsa), *AMICS 2019*, pp. 9.

Böyüközkan, G., Fethullah, G., (2018). Digital Supply Chain: Literature review and a proposed framework for future research, *Computers in industry*, Industrial Engineering Department, Galatasaray University 34349, Ortakoy, Turkey, pp. 156.

Christopher, M. (2000). The Agile Supply Chain Competing in Volatile Markets. *Industrial Marketing Management*, 29(1), pp. 37–44.

Del Sarto, N., Cruz Cazares, C., Di Minin, A. (2022). Startup accelerators as an open environment: The impact on startups innovative performance, *Technovation*, Vol. 113, pp. 1-11.

Fernández-Villacañas, M. A. (2020). The New Concept of Logistics Platforms 4.0: Creating Com-petitiveness Within the Paradigm of Global Sustainable Logistics. In U. Akkucuk (Ed.), *Handbook of Research on Sustainable Supply Chain Management for the Global Economy*, pp. 36–62.

Gunasekaran, A., Yusuf, Y.Y., Adeleye, E.O., Papadopoulos, T., (2018). Agile manufacturing practices: the role of big data and business analytics with multiple case studies. *Int. J. Product. Res.* 56 (1–2), pp. 385–397.

Ghezzi, A., Cavallo, A. (2020). Agile business model innovation in digital entrepreneurship: lean startup approaches, *Journal of business research*, Vol 110, pp. 519 – 537.

Hanninen, M., Smedlund, A., Mitronen, L., 2018. Digitalization in retailing: multi-sided platforms as drivers of industry transformation. *Baltic J. Manag.* 13 (2), pp. 152–168.

Kurt, R., (2019). Industry 4.0 in Terms of Industrial Relations and Its Impacts on Labour Life, *3rd World Conference on Technology, Inovation and Enterpreneurship (WOCTINE2019)*, pp. 592-593.

Lotti Oliva, F., Marins Freire Teberga, P., Israel Oliveira Testi, L., Kotabe, M., Del Giudice, M., Kelle, P., Pina Cunha, M. (2022). Risks and critical success factors in the internationalization of born startups of industry 4.0: a social, environmental, economic and institutional analysis, *Technological forecasting & social change* Vol 175, pp. 1-22.

Lin, H., Lin, Q. (2018). Research on the impact of supply chain integration of startups: service supply chain perspective, *Open Journal of social sciences*, Vol 6., No 4, pp. 255-274.

Ketchen, D.J. and Craighead, C.W. (2021). “Toward a theory of supply chain entrepreneurial embeddedness in disrupted and normal states”, *Journal of Supply Chain Management*, Vol. 57 No. 1, pp. 50-57.

- Pflaum, A., Prockl, G., Bodendorf, F., Chen, H. (2018). The digital supply chain of the future: from drivers to technologies and applications. Minitrack introduction, *Proceedings of the 51st Hawaii International Conference on System Sciences 2018*, pp. 3924-3925.
- Prashantham, S., Kumar, K., (2019). Engaging with startups: MNC perspectives, *IIMB Management review* Vol 13, Issue 4, pp. 407-417.
- Sang M., L., Trimi, S. (2021). Convergence innovation in the digital age and in the COVID-19 pandemic crisis, *Journal of business research*, Vol. 123, pp. 14-22.
- Schrauf, S., Berttram, P., (2016). Industry 4.0, How digitalization makes the supply chain more efficient, agile and customer-focused, *The evolution of the Digital Supply Chain*, pp. 7.
- Silva H.H., T., Sehnem. S. (2022). Industry 4.0 and the circular economy: integration opportunities generated by startups, *MDPI logistics* 6(1), 14, pp. 1-15.
- Trantopoulos, K., Krogh, G.V., Wallin, M. and Martin, W. (2017), "External knowledge and information technology: implications for process innovation performance", *MIS Quarterly*, Vol. 41, pp. 287-300.
- Wagner, S.M. (2021), "Startups in the supply chain ecosystem: an organizing framework and research opportunities", *International Journal of Physical Distribution & Logistics Management*, Vol. 51 No. 10, pp. 1130-1157.
- Valsamidis, S., I., (2020). The key drivers for the digitalization of the supply chain, *International Journal of Operations research and information Systems (IJORIS)* vol 11, issue 3, pp. 1-18.
- Weiblen, T. and Chesbrough, H.W. (2015), "Engaging with startups to enhance corporate innovation", *California Management Review*, Vol. 57 No. 2, pp. 66-90.
- Wouters, M., Anderson, J.C. and Kirchberger, M. (2018), "New-technology startups seeking pilot customers: crafting a pair of value propositions", *California Management Review*, Vol. 60 No. 4, pp. 101-124.
- McKinsey and Company (2022). Startup funding in logistics: focused investment in a growth industry, [available at <https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/startup-funding-in-logistics-focused-investment-in-a-growing-industry>, access June 15, 2022]
- EY (2021). How do you integrate startups?, [available at https://www.ey.com/en_ch/strategy-transactions/how-do-you-integrate-startups, access June 10, 2022]
- World Economic Forum (2018), The Future of Jobs Report: 2018, World Economic Forum, Geneva, Switzerland, [available at https://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf access June 7, 2022]

