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COMPARATIVE WOOD CLUSTER MAPPING WITH A SPECIAL FOCUS ON THE WOOD CLUSTERS IN EASTERN CROATIA

USPOREDNA ANALIZA MAPIRANJA DRVNIH KLASTERA S POSEBNIM OSVRTOM NA KLASTERE U ISTOČNOJ HRVATSKOJ

ABSTRACT

Over the last two decades Croatia's wood industry has recorded mostly negative trends reflected in an unfavorable structure of production (dominated by primary products), the decline in employment and unfavorable foreign trade balance for furniture products, as one of the highest value-adding products. In order to reverse the negative trends various forms of association in the wood industry have been proposed to propel growth of this important economic sector. In the last fifteen years in Croatia a significant interest has been dedicated to strategic alliances. Policymakers believe there is a great potential in clusters. The wood industry has been identified as one of the key strategic industries; different activities have been developed and a number of measures have been adopted by the Government to support the establishment of clusters. So today we have as many as 12 active clusters, which can be divided into two groups: operational clusters and clusters that represent advisory bodies and as such have no productive function. The main objective of this paper is the presentation of mapping of clusters in Croatia's wood industry with a specific purpose of assessing clusters from the eastern part of Croatia (Wood Cluster of Vukovar-Srijem County, and Wood Cluster of Slavonia). If we compare the findings of our research with data obtained by the relevant international institutions, it follows that most of the clusters in Croatia do not have the required characteristics for mapping which makes their statistical monitoring and eventually management difficult. The paper includes an example of managing operational cluster in Austria with the aim to highlight the possibilities and benefits which can be achieved by clustering. For the purpose of this paper the method of deck research was used. All relevant scientific and professional papers by domestic and foreign authors related to the research topic were studied. The results were interpreted by using the methods of comparative analysis, compilation, description, classification, inductive and deductive analysis and case study method. The aim of this research is to compare strategic management of wood clusters in Croatia with successful wood clusters in European union (Austria).

Key words: Wood Clusters, Eastern Croatia, Strategic Alliances, Cluster Mapping, Supply Chain Management

SAŽETAK

Drvna industrija Republike Hrvatske u posljednja dva desetljeća uglavnom bilježi negativne ekonomske trendove koji se ogledaju u nepovoljnoj strukturi proizvodnje (dominiraju primarni proizvodi), padu zaposlenosti i nepovoljnoj vanjsko trgovinskoj bilanci namještaja kao proizvoda s najvećom dodanom vrijednosti.

Kako bi se negativni trendovi preokrenuli predlažu se različiti oblici udruživanja u drvnoj industriji koji će omogućiti propulzivni rast ove važne gospodarske grane. U posljednjih petnaest godina značajan interes u Hrvatskoj je posvećen strateškim savezima, a nositelji ekonomske politike smatraju kako veliki potencijal leži u klasterima. Kako je drvna industrija identificirana kao jedna od strateški važnih industrija), država je različitima mjerama i aktivnostima podupirala osnivanje klastera, što je u velikoj mjeri utjecalo da ih je danas aktivno čak 12. Identificirani klasteri se mogu podijeliti u dvije skupine: operativni klasteri i klasteri koji predstavljaju savjetodavna tijela te kao takvi nemaju proizvodnu funkciju.

U radu je izvršeno mapiranje klastera u drvnoj industriji Republike Hrvatske, a posebno su analizirani klasteri iz istočne Hrvatske (klaster Vukovarsko-srijemske županije i drvni klaster Slavonije). Ukoliko se usporede rezultati istraživanja sa rezultatima koje su provele relevantne međunarodne institucije), proizlazi da većina klastera u Hrvatskoj nemaju potrebna obilježja za mapiranje što otežava njihovo statističko praćenje i u konačnici upravljanje.

U radu je iznesen primjer upravljanja operativnim klasterom u Austriji s ciljem da se ukaže na mogućnosti i prednosti koje se mogu ostvariti klasterizacijom.

U radu je primijenjena metoda istraživanja za stolom pri čemu je proučena sva relevantna domaća i strana znanstvena i stručna literatura o predmetu istraživanja, a rezultati su interpretirani korištenjem metode komparacije, kompilacije, indukcije i dedukcije, klasifikacije i metode studije slučaja.

Cilj istraživanja je komparirati strateško upravljanje drvnim klasterima u Hrvatskoj sa praksama upravljanja uspješnih drvnih klastera u Europskoj uniji (Austrija).

Ključne riječi: drvni klasteri, istočna Hrvatska, strateški savezi, mapiranje klastera, menadžment opskrbnog lanca

1. Introduction

Forestry and wood industry are important branches of Croatia's industry and, historically speaking, have generated positive economic effects in terms of employment, production and export. However, Croatia's wood industry has been stagnating for the past twenty years, recording mostly negative trends in end products, employment and export. In 1989 it employed around 75,600 people, while in 2009 the number of people employed in this sector fell to 29,907, pointing out a substantial decline in the workforce (Croatian Chamber of Commerce, 2010). Furthermore, if we compare values of production of primary products and the values of production of furniture, as products that deliver higher added value, it follows that higher primary productivity values were measured in the period from 2000 to 2008, producing a mean value of 432,4 million euros, with respect to the products with higher added value, producing a mean value of 349,5 million euros (Wood Technology Conference, 2013). Finally, Croatia's furniture import to export ratio over the 1994-2011 period (3,588,227.129 euros / 3,060,211.824 euros) indicates an inadequate wood industrial development strategy.

Various solutions have been proposed to reverse these negative trends such as exporting products of a higher degree of processing, building infrastructure networks to support the development process, making new development policy for wood industry etc. Clustering strategy is being suggested as the most effective long-term solution to linking functionally all the entities in the wood industry, which should jointly try to change the unfavorable production structure in this industrial sector providing benefits to production and export of end products. In Croatia, first ideas on industrial clusters were launched in 2003, mainly on government initiatives (top-down approach), and then were created and developed in the private sector (bottom-up approach). Government-operated clusters have not returned the expected results, because in most cases they haven't even started operating (Klaster drvo-namještaj [Wood and Furniture Cluster] as planned by the Croatian Export Offensive, 2006). Only a few clusters (Drvni klaster Zapadne Hrvatske [Wood Industry Cluster of Western Croatia]. Drvni klaster Vukovarsko-srijemske županije [Wood Industry Cluster of Vukovar-Srijem County]) have been able to successfully enter the EU market. In 2015, we have three active clusters built by top-down approach (Drvni klaster Vukovarsko-srijemske županije Wood Industry Cluster of Vukovar-Srijem County]. Drvni klaster Virovitičko-podravske županije [Wood Industry Cluster of Virovitica-Podravina County], and Hrvatski klaster konkurentnosti drvno preradivačkog sektora [Croatian Competitiveness Cluster for Wood Processing Industry]), as well as nine clusters established on private sector initiatives. Economic effects did not materialize as expected partly also, because of inappropriate models of organizational structure that are based on horizontal rather than vertical process integration of cluster members.

2. Cluster - model of strategic integration of business systems

Over the last twenty years, the academic community has devoted considerable attention to the phenomenon of business cluster, and the analysis of various driving forces behind cluster creation and development. Trends in business organization change as competition intensifies. The importance of linking local diminishes, as the importance of regional and recently global business strategies grows. Today, distance is no longer a relevant barrier for organizing business. The impact of contemporary factors is increasing; knowledge, information and technology facilitate the unimpeded flow of money, materials and information between business systems in a globalized market. The modern concept of cluster that lays emphasis on functional relationships between members, proved to be a successful model for achieving economic benefits (economies of scale, flexible specialization, innovation) in a large number of labor intensive industries (wood, steel, shipbuilding) and capital intensive industries (film, IT etc.).

When defining the concept of cluster we depart from Michael Porter's cluster theory. In his book "The Competitive Advantage of Nations" (1990) he has formulated the most influential definition of a cluster: "geographic concentrations of interconnected companies and institutions in a particular field". Porter believes that clusters occur in many types of industries, and involve interactions with other entities contributing differently to gaining competitive advantage such as suppliers of various inputs, as spare parts manufacturers, finished products manufacturers, equipment manufacturers, suppliers of intellectual service, supporting institutions (banks, scientific and educational, research centers) or entities that provide access to specialized infrastructure. Clusters may involve cooperation between members at the same (horizontal) or different (vertical) stages along the production chain. It is not uncommon for companies to share technology, production inputs, infrastructure and manpower. Also, the Government is helping many clusters providing them support through its institutions, which include universities, supporting agencies, specialized training institutions, trade associations and financial institutions, playing the role of education, information, research and technical support.

3. Mapping of Croatia's wood-based industry clusters

To date, only one relevant study on the mapping of wood-based industry clusters in Croatia has been undertaken by competent institutions. In 2011, a document entitled *Report on Cluster Mapping* was released, which identified four clusters in Croatia's wood industry: *Drvi klaster* (Wood Industry Cluster), *Zadruga Slavonski hrast* (Cooperative Society 'Slavonian Oak'), *Drvni klaster Vukovarsko-srijemske županije* (Wood Industry Cluster of Vukovar-Srijem County) and *Hrvatski interijeri*. The report does not take into consideration organizational specifics of cluster initiatives. It is therefore impossible to make exact analysis of internal processes between members based on the published results, neither it is possible to conduct a comparison of internal processes with wood clusters in the European Union.

The issue of cluster mapping in Croatia is multifold. Firstly, statistical monitoring of clusters in Croatia depends on the legal framework on which it is built. Taking into consideration that any kind of association in the wood industry is called a cluster, today in Croatia we have 12 active clusters, which differ in a conceptual and organizational way. There are no specific legal regulations concerning clusters, so trying to categorize and differentiate them is proving difficult both at a national and international level. Secondly, according to a Meta study from the United States, the minimum number of members required to establish a new cluster is 150 indicating huge disparity with respect to the average number of companies in Croatia's clusters (13.66). According to this criterion clusters in Croatia do not have the required characteristic therefore cannot be mapped. Thirdly, the problem of cluster mapping in Croatia comes into the picture when we try to analyze data from corresponding foreign institutions that are relevant for cluster mapping (European Cluster Observatory and the Institute for Competitiveness). The European Cluster Observatory represents a relevant database with a variety of information, analysis, business and statistical indicators which are used for cluster mapping and also provide guidance on the existing clusters for strengthening competitive advantage. According to the Observatory, which has more than 2000 registered regional clusters at its base, there are no active clusters in Croatia's wood industry. This result is a consequence of cluster mapping methodology that includes geographic and functional characteristics. While the geographic boundaries are somewhat easy to prove, because it is assumed that the boundaries of a cluster correspond with the existing national and regional boundaries, functional relationships between members are much harder to prove, at least when speaking of Croatia. Using input-output analysis we can identify groups in interrelated vertical fields (Feser and Czamanski, 1974; Roepke et al., 1974, Hauknes et al., 1999), proving Bergman, 2000: relationships between suppliers, manufacturers and customers along the supply chain. While the European Cluster Observatory analyzes data primarily from the European Union, Institute for Competitiveness collects data on clusters at a global level. The Institute was founded in 1998 and involves experts and scholars from various fields. The aim of the Institute is mapping and detailed analysis of cluster initiatives and their competitive advantages. According to the Institute, there are two registered clusters in Croatia, Tehnointerijeri and Drvni klaster Sjeverozapadne Hrvatske (Wood Industry Cluster of Northwestern Croatia). These clusters are characterized by vertical integration. Their members appear jointly on markets, although not in the production of complementary products, but in providing the service of furnishing facilities, in which the methodologies of the Institute for Competitiveness established its foothold.

The methodology of the Institute for Competitiveness is relevant for this study. Unlike other cluster mapping methodologies, it is not only based on a minimum number of members, but also takes into account functional relationships between members (vertical and horizontal configuration). From the aforementioned, it can be concluded that there are more active clusters in Croatia comparing to the number of clusters as mapped by foreign institutions. Besides two vertical clusters, there are also ten horizontal clusters. Croatia's clusters are listed in Table 1. They can be divided into operational and advisory. Operational clusters are seeking to make a joint appearance on the market by participating in the implementation of business processes through the orchestration of activities. The goal of advisory cluster is not a procedural cooperation between members, but giving

guidelines to the competent ministry or the Government with regard to the formation of strategies in the wood industry.

Name of the cluster	Number of	Cluster type
	members	
Drvni klaster Sjeverozapadne Hrvatske (Wood Industry	15	
Cluster of Northwestern Croatia)		
Tehnointerijeri	20	
Udruga malih pilanara PGŽ (Association of Small-sized Sawmills of	15	
Primorje-Gorski Kotar County)		
Klaster drvnih prerađivača LSŽ (Wood Processing Industry Cluster of	13	
Lika-Senj County)		
Drvni klaster Zapadne Hrvatske (Wood Industry Cluster of Western	4	
Croatia)		Operational clusters
Drvni klaster Vukovarsko-srijemske županije (Wood Industry Cluster	22	
of Vukovar-Srijem County)		
Drvni klaster Virovitičko-podravske županije (Wood Industry Cluster	6	
of Virovitica-Podravina County)		
Hrvatski interijeri	10	
Proizvođači masivnog namještaja (Solid Wood Furniture	6	
Manufacturers)		
Zadruga Slavonski Hrast (Cooperative Society 'Slavonian Oak')	12	
Hrvatski klaster konkurentnosti drvno prerađivačkog sektora (Croatian	37	
Competitiveness Cluster for Wood Processing Industry)		Advisory clusters
Drvni klaster Slavonije (Wood Industry Cluster of Slavonia)	4	
Total members	164	

Table 1: Wood-based industry clusters in the Republic of Croatia

Source: author

There are three clusters operating in the region of Slavonia: Drvni klaster Slavonije (Wood Industry Cluster of Slavonia) (4), Drvni klaster Vukovarsko-srijemske županije (Wood Industry Cluster of Vukovar-Srijem County) (22) and Zadruga Slavonski Hrast (Cooperative Society 'Slavonian Oak') (12). The Wood Industry Cluster of Slavonia is made of the following companies: TWIN Ltd., SPIN Valis, Brestovec j.s.c. and AG-Dinas. The companies have joined together in a cluster to promote, develop and improve domestic wood industry, ensure cheap supplies of raw materials and production materials, improve national and international marketing and develop favorable relationships with banks, funds and public institutions (VIDRA (Regional Development Agency of Virovitica-Podravka County), 2011). The Wood Industry Cluster of Vukovar-Srijem County brings together wood-processing manufacturers, scientific and educational institutions and local communities as well as other interested parties relating to forest exploitation and wood processing including marketing, research, development, innovation and improvement of products and technology aimed at promoting Slavonian oak and increasing competitive advantage, production and employment in companies dealing with wood processing and production of wood products. Presently the cluster has 22 members, of which 3 institutions and 19 wood-processing manufacturers (http://drvni-klaster-vsz.com/index.php?link=2, as of 1 Feb 2015). The cooperative society "Slavonian oak" brings together craftsmen that manufacture products made of oak. The cluster members are primarily dealing with common oak, which grows in the Slavonian forest, and offer a complete range of products from this oak. They aim to strengthen their own bargaining power, following a strategy of product diversification and expand their market share. Analysis of the cluster's activities reveals horizontal cooperation as the dominant form of cooperation between members of the cluster. Horizontal cooperation means that there is no vertical supply chain, or process integration of members with the aim of producing a joint end product with high added value.

4. Supply chain in the wood industry

Supply chain is a term that encompasses all activities involved in the production and distribution of the end product from supplier's supplier to the consumer's consumer. The American Production and Inventory Control Society define supply chain as a set of interdependent processes, from the initial raw materials to the ultimate consumption of the finished product linking across supplier-user companies in an integrated process (Apics, 2011, 1). Supply chain includes all the activities inside and outside the company enabling creation of products or services for the final consumer. In the wood industry, a supply chain involves various participants who make part of the value adding process at different stages of production. As the wood industry is characterized by the complexity of the overall system, or in other words, it involves many interdependent activities (production of furniture, paper, wood-pulp, bio-fuel) that are closely related to forestry, implementation of supply chain management practices is complex in terms of integration of all the participants into a single supply chain.

4.1. Supply chain in Croatia's wood clusters

In Croatia's wood industry, clusters have been established in sawmill industry and furniture manufacture with the aim to form an internal supply chain, which is to strengthen the competitive advantage of individual companies. By analyzing internal supply chains in Croatia's wood clusters we can identify a dominant, horizontal form of cooperation between members.



Scheme 1: Internal supply chain in Croatia's wood clusters

Source: author

Scheme 1 reveals a horizontal supply chain which is characteristic of wood clusters in Croatia. Companies primarily collaborate on the same level of the supply chain which means that they produce and sell identical or similar product intended for common market. Horizontal cooperation is particularly expressed in sawmill clusters and the Cluster of Slavonian oak, as companies produce products with a low degree of differentiation. The cluster members have joined together primarily to improve procurement of raw materials and achieve better market appearance, so that horizontal cooperation is expressed only in the procurement of raw materials, and not in the exchange of tacit knowledge which would result in the production of common competitive

products. Horizontal cooperation is particularly evident in the Wood Industry Cluster of Slavonia which is an advisory cluster. The purpose of the cluster is to connect all the relevant economic entities around common objectives, strategies and priorities based on which research, development, business and other activities are designed and carried out to increase competitiveness of the whole industry. In furniture clusters and the Wood Industry Cluster of Vukovar-Srijem County members are partly vertically integrated, since it involves producing products of a higher degree of processing. The companies have joined hands with the aim of joint market approach and intensively participate in activities that are likely to help them in finding and capturing new market niche that is not the case with vertically integrated clusters. In order to establish vertical integration it is necessary that the cluster members specialize in their field (efficiency), which will strongly contribute to the innovation capacity of all the members and the achievement of economies of scale (effectiveness).

4.2. Supply Chain of Austrian Wood Industry Cluster

Wood Cluster Styria in Austria was founded in 2004 as operational cluster. The cluster's core business activity is production of furniture and wood constructions including planning and designing, assembling components and furniture manufacture. As we can see in Scheme 2, the Austrian cluster is characterized by more operational levels comparing with Croatia's clusters as it integrates various enterprises and supporting institutions that are performing activities at different process levels thus contributing to the improvement of the final product and increasing the added-value.



Scheme 2: Supply Chain of Austrian Wood Industry Cluster

Companies that participate directly or indirectly in a value creation chain can be classified into three categories, depending on the position in a chain of furniture production - primary manufacturers (furniture), secondary manufacturers (components and spare parts) and materials suppliers. Primary manufacturers include companies that participate actively, on a daily basis in a chain of furniture production, including companies that are participating at the intermediate stages (sawmills, dry kilns, furniture manufacturers, manufacturers of metal frames, veneer manufacturers, paint shops, upholsterer's workshops and furniture stores). Secondary companies include entities that produce material inputs used in production process to improve the final product. These entities are indirectly involved in the furniture manufacturing process and include various activities (glass manufacture, metal processing, and textile industry). Such companies can foster integration of business processes related to the furniture in order to gain a competitive edge. The third category includes suppliers of inputs which may comprise suppliers of materials, equipment and machinery for the production of furniture or production materials. Suppliers may be retailers, distributors or agents often located

outside the geographical boundaries of the cluster, but are still part of the internal supply chain. The Austrian Wood Industry Cluster is characterized as vertical integration wherein the companies are motivated to cooperate along the process to build a single internal supply chain with the aim of manufacturing and distributing joint products to end customers. The Austrian Wood Industry Cluster is an example of strategic alliance built on contemporary concepts of supply chain management.

5. Supply Chain Management - a precondition for the efficient functioning of wood cluster

Supply chain management is a set of components and functions related to the procurement of materials, including manufacture, to the final delivery of finished products and services to the customer (Zekić, 2000, 99). This concept incorporates the flow of materials, information and finances between a minimum of three companies in a strategic alliance, from the starting point in the supply chain to the place of consumption of products or services, with the aim of maximizing customer satisfaction at the lowest possible expense. The Austrian Wood Industry Cluster is an example of cluster of a successful implementation of the concept of supply chain management. The cluster has a more complex organizational structure comparing with Croatia's clusters, primarily due to a larger number of members that cooperate at different production stages, and thus creating an integral, internal supply chain. The cluster involves interactions with all the process-related entities from primary raw material processing to direct distribution to end customers. Such approach reveals that companies in Austrian Wood Industry Cluster not only cooperate in logistics activities but also in marketing, sales, service, manufacturing processes and research and development, which suggests that the concept of supply chain management has been effectively implemented enabling an efficient management of vertically integrated strategic alliance. The Austrian Wood Industry Cluster is characterized with a full process integration, which integrates individual material flows in a single material flow moving from raw material supplier to end customer. Also, a single supply chain enables members to exchange information in both directions, which is important from the perspective of creating future business strategies. Finally, the money comes at the end of the supply chain and is transferred to the members that are closer to the origin of the supply chain. Optimizing the flow of the supply chain leads to the optimization of business processes in the cluster as a system including all of its entities.

5. Conclusion

Business clusters have been recognized as a promising model for interconnection of business entities in wood industry, which could improve the competitiveness of this important industrial sector in Croatia in the long run. When speaking of Croatia, first clusters were established in 2003, but they have not returned the expected results, mainly because they have not been organized according to the modern conception of clusters. Differences between clusters in Croatia and European Union in terms of conceptual and organizational issues imply that there is a problem of mapping, which is especially evident when analyzing research data produced at relevant institutions such as the European Cluster Observatory and the Institute for Competitiveness. According to the results of the cluster mapping, there are only two clusters in Croatia. However, according to Croatia's laws we have twelve active clusters, of which three in the region of Eastern Croatia. The problem of functional management of clusters in Croatia is related to the lack of implementation of the concept of supply chain management in the overall management system. The concept of supply chain management allows for integration of members in a single business system that is a function of the optimization process of the transformation of raw materials into finished products. Croatia's clusters have still not established vertical integration or the internal supply chain, which is a major limitation of exploiting the full potential of the cluster and generally resources in the wood industry. Without building a single internal supply chain whose purpose is efficient production of a competitive final product or service, it is unrealistic to expect achievement of business benefits arising from modern clustering strategies (innovation, flexibility, economies of scale). It is therefore necessary to establish a vertical supply chain to implement unique supply chain management techniques to take the advantages of specialization (efficiency), innovation and competitiveness and economies of scale (effectiveness), which could significantly improve their performance.

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