Analiza utjecaja odabranih čimbenika menadžmenta opskrbnog lanca na poslovanje drvnih klastera u Republici Hrvatskoj

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ANALYSIS OF THE IMPACT OF SELECTED SUPPLY CHAIN MANAGEMENT FACTORS ON THE PERFORMANCE OF WOOD INDUSTRY CLUSTERS IN THE REPUBLIC OF CROATIA

The purpose of this study is to determine the importance of supply chain management (SCM) in Croatian wood industry clusters by investigating the relations between information technology, partner relationships, the value added process and supply chain performance as well as the relation between supply chain performance and the competitive advantage of members within the clusters. The study included 20.8% of the companies being part of Croatian wood clusters. The first phase involved a survey among these companies. The collected data was then subjected to factor analysis to identify supply chain management factors. The last phase involved a multiple regression analysis to test the impact and contribution of individual factors on supply chain performance as well as the impact of supply chain performance on competitive advantage. It has been established that only the partner relationship has proven to be relevant, while the contributions of the value added process and information technology have not. The absence of these two important factors suggests that cluster members are not functionally linked and that clusters are primarily established on geographic principle. The findings indicate a need to change the management paradigm in Croatian wood in-

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dustry clusters by putting greater focus on the functional rather than geographical integration of members, which is still dominantly present as the basic criterion for establishing clusters in transitional countries.

Key words: Wood Industry Clusters, Supply Chain Management, Competitive Advantage, Functional Connectivity

1. Introduction

During the last twenty years, the academic community has devoted considerable interest to the phenomenon of business clusters and the analysis of various driving forces affecting their creation and development. The intensification of competition has changed the ways in which business activities are organized; the significance of being connected locally has decreased, while regional connectivity and recently global organization of business activities are gaining on importance. Clusters are defined as geographic concentrations of interconnected businesses. While in the past the concept of clusters related to a city or a district, nowadays, the scope of their business has expanded and there are many corporations doing business globally, on cluster principles (example: Toyota, Husqvarna). The number of clusters in the world is increasing, and the benefits realized through cluster integration are numerous (increase in innovation capacity, flexible specialization and economies of scale).

As transitional countries become aware of the advantages gained by cluster organization, the clustering process in various industries started as early as the 1990s. The Republic of Croatia was no exception. With the support of the State, several clusters were formed in wood industry from 2000 to 2010. However, unlike its West European counterparts (example: Austria, Italy and Slovenia) which are competitive, both in domestic and global markets, Croatian clusters are either stagnating or ceasing to exist. There are many external reasons for this (the legal environment, unstable market, weak purchasing power ...) but also internal, which are primarily related to the inadequate system of cluster management. Although clusters, as complex organizational systems, vary from country to country and have different legal forms, they have two common dimensions, geographic and functional one. The geographic dimension had a great importance in the 18th century when the industrial districts of that time, in fact precursors of the modern concept of clusters, were the drivers of urban and regional development. The geographic dimension was of importance in those times as it was the main criterion for classifying clusters, and has remained so until today. The second dimension, the functional one, refers to the interconnection among cluster members. As to-

day's clusters in capital intensive industries (example: banking, film…) operate across several continents, it is evident that the benefits arising from clustering do not depend so much on geographical location but on the intensity and model of interconnectivity between the members within the cluster i.e. their functional dimension. Since one of the concepts positively contributing to the interconnectivity between members within the cluster is supply chain management (SCM), this paper aims to establish its presence, and the effects it has on the performance of wood industry clusters in Croatia.

The concept of supply chain management has become an essential factor for the survival and the success of a large number of capital intensive industries. Positive examples of its implementation can be found in banking, IT, fashion, film and pharmaceutical industries. If we analyse its application in labour- intensive industries (example: wood, textile, graphic...) it can be concluded that the supply chain management concept in these industries is neither as widespread nor as efficient as it is in capital- intensive industries. This is partly due to the fact that labour- intensive industries are not based on information technology thus limiting its full implementation. However, as these are industries that create added value through cooperation with a number of entities at different levels, the application of the SCM concept is necessary in order for strategic alliances to be competitive.

In the context of expanding the present knowledge regarding the application of supply chain management, there are a number of scientific gaps this study aims to fill. Although Sureephong et al. (2008) and Kaplinsky (2000) proved that the concept of supply chain management has a positive effect on the performance of wood industry clusters, there was no detailed research identifying individual contribution of SCM factors, such as value added process (VAP), partner relationship (PR), information technology (IT) or competitive advantage (CA). Moreover, there is no study exploring the mediating role of supply chain performance (SCP) in achieving competitive advantages.

The theoretical contribution of this work lies in the dissemination of notions on the applicability of the SCM concept in wood industry clusters. Proving its impact is significant as it allows for gaining important notions on the interconnectivity among cluster members which is a precondition for fulfilling the functional dimension of clusters. The above is tested by determining whether and to what extent SCM factors (added value process, partner relationship and information technology) affect competitive advantage.

The research results clearly indicate that it is necessary to increase the level of awareness of the benefits to be gained by implementing the factors of the SCM concept (value added process and information technology) among all Croatian wood industry stakeholders. It is primarily necessary to increase the contribution of information technology and partner relationships, as, according to research

findings, their contribution is not relevant in the management of Croatian wood industry clusters which, in turn, is ultimately reflected in their competitive ability.

The research represents a significant contribution to science in terms of application of the supply chain management concept, bearing in mind that no studies so far have been conducted to assess the factors of supply chain management that influence the functioning of clusters in wood industry. The research proved that applying the concept of supply chain management does not seem to contribute to the competitive advantage of Croatian clusters, which is important and useful knowledge to cluster managers and creators of the national industry cluster development strategy.

The work consists of five parts. The first part - Introduction, explains the concepts of cluster and supply chain management and presents previous studies conducted on application of the concept of supply chain management in wood industry and wood clusters. The second part elaborates theoretical background of resulting implications of the impact of supply chain management factors in complex business systems. For the purpose of the study, the following factors have been investigated thoroughly: information technology, value added process, partner relationships, supply chain management performance and competitiveness. The third part presents the research model and hypothesis. The fourth part includes the research methodology that involves designing questionnaires, pilot study, data collection and research results. In the last, fifth part, the research results involving a theoretical contribution, implications for practitioners and research limitations are interpreted.

2. Theoretical background

Clusters are business systems formed of space and process related suppliers, manufacturers and institutions, in which their interconnectivity is based on identical or similar work, activities, processes, technology and knowledge (Porter, 1990). Although they historically took on different legal forms and names (industrial district, corporations, networks), clusters have been in existence for many years and are characteristic of a large number of industries and business activities. Originally, they were typically present in labour- intensive industries (such as steel or shipbuilding), while nowadays, they are becoming more and more present in capital- intensive industries (such as banking, information technology and the film industry).

In a theoretical sense, clusters are an effective organizational model of connecting businesses that contribute to economic and technological development of,

primarily, small and medium size companies (Gudda, et al., 2013). It has been proven that they have a positive impact on regional development and competitiveness of a specific industry (Porter, 1998); they contribute to overcoming the gap between the SMEs' economies of scale; they create synergy effects, increase productivity and contribute to stronger competitiveness of companies within the cluster. Namely, the concentration of interconnected companies, institutions and organizations creates a critical mass of knowledge, technology and resources which, in turn, form the preconditions for strengthening the competitiveness of companies within the cluster, and consequently, the cluster as a whole.

Clusters are not an unknown concept in transitional countries. They existed in planned economy but were established on different, non-market, settings. They used to be typical of large state *kombinats* and companies that had a large number of suppliers and a determined number of permanent customers. Moving to market economy, the existing modality of managing clusters became inefficient and unsustainable. This brought about the need to change their management system in order to avoid shutting down ~~the~~ industry in which they operate. Changes in cluster management systems in transitional countries are accompanied by a number of structural problems, especially in labour- intensive industries such as the wood industry. Newly established clusters failed to adapt to the dynamic changes and to this day have not yielded expected results.

In order to determine the reasons for the inefficient management of clusters in transitional countries, the authors analyse the management systems in Croatian wood industry clusters. Even though the clustering processes in the Croatian wood industry began in the early 1990s, they did not yield expected positive effects and today's clusters are uncompetitive regionally let alone globally. One of the reasons for their failure lies in the fact that clusters are primarily established on state initiatives and their failure rate, especially in transitional countries, is high. This research aims to provide one of the possible reasons for this. In order to do so, it is necessary to analyse the fundamental postulates of clustering as well as their application in the context of today's dynamic business operations.

According to the basic postulates, clusters have two dimensions: geographical and functional. The geographical dimension implies that companies cooperate in a particular territory whereas the functional one implies the way in which companies are related. Today, cluster boundaries can easily be defined. However, the effects of the interconnectivity among members is not easy to measure especially in clusters which do not have a system of internal control processes. It has been proven that successful clusters in the automotive (Toyota) and shipbuilding (Glasgow) industries are characterized by a strong interconnection among participants along the supply chain implying that interconnected production processes have successfully been implemented. The existence of a value chain resulting in

production of a high added value product (e.g. a vehicle) indicates that that the supply chain management concept has successfully been implemented within the cluster management system.

A supply chain management consists of at least three organizations directly involved in the downstream and upstream flows of materials, information and finances (Mentzer et al. 2004). In today's highly competitive environment, there is no effective alternative to the concept of supply chain management in the management of complex business systems, such as clusters. Supply chain management coordinates resources and optimizes activities in order to gain competitive advantage over the competition (Gunasekeran et al. 2008). Today, the concept of supply chain management is an inevitable part of the management philosophy of strategic alliances in IT, film, transportation, banking, food, pharmaceutical and many other industries.

The importance of the implementation of the SCM concept in wood industry is witnessed by the works of P. Maskell (1998), J. Bessant et al. (2003) and Pretorius (2001). According to these authors, the emphasized role of the SCM concept is that of an integrator of flows exclusively within independent business systems (furniture manufacturers), but not that of an integrator of flows within strategic alliances as a set of interconnected business systems such as clusters. Previous studies have confirmed the positive impact of the SCM concept on the performance of capital intensive industries. This study wants to determine the possibility of its application in wood industry.

An extensive overview of theory discovered a theoretical gap. Namely, only a small number of works used relevant statistical methods, and thus the theoretical basis for researching the application of SCM in wood industry clusters primarily relies on the works by Quesada et al. (2011) and Li (2002).

In order to demonstrate the importance of applying the SCM concept in wood industry, Quesada et al. (2011) formed a research model that included SCM factors describing the success of its application in complex business systems: information technology, value added process, partner relationships within the supply chain (independent variables) and supply chain performance and competitive advantage (dependent variables). In their study, the authors demonstrated that the selected factors strongly affect supply chain performance and that supply chain performance strongly affects competitive advantage, which is proof of the positive impact of the SCM concept on a company's business operations. As this research analysed pallet production, which is an integral part of wood industry, it provides a starting point for demonstrating the effects of SCM implementation in wood industry clusters. However, the study researched entities at the same (manufacturing) supply chain level, mainly companies producing low differentiation products (pallets), while the companies within wood industry clusters form a supply chain and produce furniture which is a higher value added product.

The analysis of the impact of partner relationships, information technology and supply chain performance on the competitive advantage of furniture manufacturers was conducted by Li in 2011. On a sample of 196 manufacturers with over 100 employees, Li found that the partner relationships (suppliers and customers) and information technology strongly affect supply chain performance. Moreover, it was found that supply chain performance has a mediating role and affects a company's competitive advantage.

Since Quesada and Li conducted their research in the wood industry using relevant statistical methods (factor and multiple regression analyses), they form the grounds for defining the research model in the analysis of the implementation of the SCM factors in wood industry clusters. Verifying the effects of SCM application in wood industry clusters is important in order to determine the importance of the functional dimension of wood industry clusters in Croatia, as a transitional country with a similar strategy of managing clusters.

Given the clusters' business activity (sawmills and furniture manufacturers), the manner of their establishment (vertical and horizontal), previous research on supply chain management in wood industry and current trends in wood industry, the authors defined the factors relevant for proving the effects of applying the supply chain management concept in wood industry clusters.

2.1 Information technology

Turner (1993) believes that a company cannot effectively manage costs, provide superior customer service and be successful in managing the supply chain without the active support of information technology. The implementation of IT tools such as ERP, EDI, Internet, and Extranet helped many organizations to achieve competitive advantage (Jones, 1998). Today, the investments in information technology are also notable in labour- intensive industries (e.g. wood). Namely, IT facilitates diversification, shortening of production time and outsourcing of activities between partners within a strategic alliance. For these reasons, it is very difficult to achieve competitive advantage without the active support of information technology. Information technology enables shortening of the time needed to execute activities, acceleration of processes within the system, better coordination of activities, monitoring of employees' performance, inventory management, customer relationship management, etc. Based on the analysis of relevant literature, three IT factors that mostly affect the performance of contemporary strategic alliances have been identified; IT equipment (Samaržija, 2014), communication tools (Bowersox et al., 2007 and O`Neill, 2008) and integrated information systems (Chizzo, 1998; Kumar 2001; Tan, 2001).

2.2 Value added process

The processes that add value may result in creation of new products or improvement of existing ones. According to Bishop (1990), value added is defined as: 'adding those manufacturing or service steps to a commodity product, which the customer perceives as increasing its value'. The wood industry is characterized by a multiphase production which usually includes several entities within the supply chain, especially when it comes to producing more complex products such as furniture. The process of adding value is an important factor as it ultimately affects products' characteristics and performance and eventually buyers' choice. Putting the focus on the value added process is necessary because a buyer is willing to pay the price which he/she perceives as fair, and if the buyer receives a bit more, he/she will perceive this as an increase in the accrued value. The three most important factors that affect the value creation process are flexibility (Bowersox et al., 2007), the production system (Bishop, 1990 and Juran 1988) and the quality of production processes (Bishop, 1990 and Juran 1988).

2.3 Partner relationships

Partner relationships are defined as the level of trust, commitment and sharing of a common vision between trading partners. Information technology is often used to efficiently synchronize material flows among supply chain participants. However, modern technology cannot regulate organizational relations between participants. Trust and commitment are essential factors in building cooperative ties between trading partners (Spekman et al., 1998). Handfield and Nichols (1999) argue that efforts directed towards managing material and information flows will be futile unless there is an effective relationship based on trust between partners. Cooperative relations between partners imply a management of flows in which both ends of the supply chain i.e. suppliers and customers are involved. Nowadays, cooperating with a small number of suppliers has become a trend among manufacturers as it ensures timely delivery of goods at predictable prices and of expected quality, which affects the continuity of production processes and ultimately the acceptance of products by customers. Successful business systems in capital intensive industries put significant efforts in establishing long-term partnerships with their customers as this brings them a predictable market placement of their products or services. Partner relationship management is an important factor in supply chain management because it focuses on planning future needs which, in turn, positively affects supply chain performance.

2.4 Supply chain management performance

In the act of forming supply chains, the management of the strategic alliance should define supply chain performances that will serve as indicators whether and to what extent different factors within the supply chain are successfully implemented. Therefore, supply chain performances are an important component in design of the supply chain. According to Beamon (1998), indicators are used to establish the effectiveness of the existing system or to compare it with another. In practice, the following indicators are most commonly used: supply chain flexibility, supply chain accessibility, supply chain visibility, supply chain integration and partnership quality. Given the level of cluster development in Croatia as well as the practice of supply chain management implementation in vertical systems, this paper analyses the following three factors: supply chain flexibility, supply chain integration and partnership quality.

Supply chain flexibility is defined as the ability of an organization to effectively adapt to changes in the external environment (Vickery et al. 1999). Shortening product life cycle and frequent changes in consumer preferences put pressure on strategic alliances forcing managers to create a system which is able to adapt to the rapid changes in the environment.

Supply chain integration defines the extent to which all the activities within an organization are performed by partners, suppliers and customers, are mutually synchronized (Stock et al., 1998; Narasimhan and Jayaram, 1998; Wood, 1997). Supply chain integration is important for maintaining the continuity of business processes directed towards business system optimization. Integration aims to bring together participants from both ends of the supply chain in order to ensure continuous flow of materials, information and finances, from the supplier - through the company's transformation processes - to the customer.

Partnership quality defines the extent to which the expectations of partners cooperating within the strategic alliance are met. In many cases, strategic alliances are composed of companies at different development stages resulting in a discrepancy of bargaining powers, giving some participants superiority over others. Since the main objective of a strategic alliance is to increase market share, it is necessary to take into account the needs of all members regardless of their position within the supply chain.

2.5 Competitive advantage

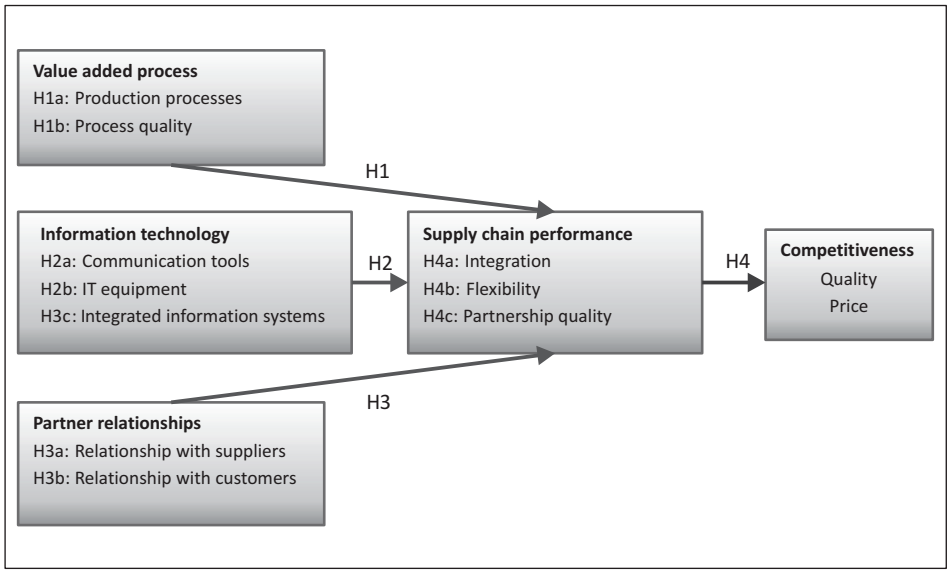
The design of supply chain is oriented towards providing the opportunity for individual companies, as well as the overall strategic alliance, to achieve competitive advantages. The objective of implementing supply chain management factors is to improve the efficiency of the system, which should be reflected in the effectiveness of the supply chain. The effectiveness of a business system allows the company to reach a higher level of competitive advantage over its rivals, which in turn allows the system to generate more revenue, achieve higher margins, produce higher quality products, or maintain the existing customers in relation to their competition. The clusters in the wood industry may contribute to their competitiveness primarily in two ways: by lowering costs (Koufteros, 1995; Wood et al., 1990) or through differentiation in the quality of their products and services (Koufteros et al., 1997)

3 Research model and hypotheses

Figure 1 shows the research model applied to establish the relationship between supply chain management factors: information technology, partner relationships, value added process and supply chain performance (efficiency), and the relationship between supply chain performance and competitive advantages (effectiveness). Figure 1 also shows the correlation between independent variables (value added process, information technology, and partner relationships) and dependent variables (supply chain performance and competitiveness). The proposed model aims to establish the individual contribution of each factor in order to determine the intensity of their implementation and their generated effects on wood cluster performance.

Figure 1:

SUGGESTED RESEARCH MODEL



3.1 The relationship between value added process and supply chain performance

The importance of the value added process within the supply chain management concept has been recognized by several authors (Bishop, 1990; Juran, 1988; Beneto et al., 2009; Bowersox et al., 2007). This study tests the possibility of its application in wood clusters. The H1 hypothesis of the established model reads: the value added process significantly affects supply chain performance. In order to gain a better insight on the effects of the value added process, two factors have been defined (production processes and process quality). Consequently, the first auxiliary hypothesis reads: production processes significantly affect supply chain performance. This hypothesis is tested to determine whether established processes affect supply chain performance. The second hypothesis reads: process quality significantly affect supply chain performance, and it is applied to determine whether clusters in Croatia implement control systems and the extent of their impact on supply chain performance.

H1 The value added process significantly affects supply chain performance.

H1a Production processes significantly affect supply chain performance.

H1b Process quality significantly affects supply chain performance.

3.2 The relationship between information technology and supply chain performance

Information technology has a wide range of application and results in a variety of positive effects in various industries (Bowersox et al., 2007; O`Neill, 2008; Tan et al., 2009; Simchi-Levi et al., 2003; Turner, 1993). Therefore, it is assumed to be a significant factor in the chain of creating added value in wood clusters. Consequently, the hypothesis H2 tests the impact of information technology on supply chain performance. There are three factors describing information technology: communication tools, IT equipment and integrated information systems. The aim of this hypothesis is to determine the individual contribution of each of these factors.

H2 Information technology significantly affects supply chain performance.

H2a Communication tools significantly affect supply chain performance.

H2b IT equipment significantly affects supply chain performance.

H2c Integrated information system significantly affects supply chain performance.

3.3 The relationship between partner relationships and supply chain performance

Partner relationships in the supply chain are the backbone of the SCM concept (Hines, 2004; Li et al., 2005; Burgess, 1998; Hoek, 1999; phrase, 2000). Because of the large number of involved entities in wood industry, the importance of making the right choice of supplier and customer in vertical integration is of great significance as it provides for the product to be delivered within the planned time to a target destination. Consequently, hypothesis H3 reads: partner relationships significantly affect supply chain performance. Testing the model aims to determine the individual contribution of each factor to supply chain performance, thus the auxiliary hypotheses read:

H3a Relationships with suppliers significantly affect supply chain performance.

H3b Relationships with customers significantly affect supply chain performance.

3.4 The relationship between supply chain performance and competitive advantage

Proving the positive and statistically significant contributions of supply chain performance to competitiveness represent the backbone of the research model. Under the proposed model and in order to prove the basic hypothesis of the paper, supply chain performances should statistically significantly affect competitive advantage ($p < 0.05$). By proving the model hypothesis, a direct connection will be drawn between the efficiency and effectiveness of the system, which represents an important notion in the formulation of strategies affecting future development of wood industry clusters. Similar conclusions were drawn by Håkansson and Prenkert (2004) according to which, effectiveness is a direct consequence of the efficiency of internal processes within a business system. While efficiency is focused on measuring the efficiency of internal processes, effectiveness represents an external standard applied to measure the effectiveness of the organization in creating business solutions that positively impact the organization's competitiveness. As supply chain performance is described by different indicators, three auxiliary hypotheses are formed to test individual contributions of each of these factors.

H4 Supply chain performance significantly affects competitive advantage.

H4a Supply chain integration significantly affects competitive advantage.

H4b Supply chain flexibility significantly affects competitive advantage.

H4c Partnership quality significantly affects competitive advantage.

4 Research methodology

4.1 Questionnaire design and pilot study

The research model was formed based on an extensive review of the literature in the field of supply chain management, field research of functioning of wood

clusters in Croatia and a comparative analysis of the way in which the organization of the Wood Cluster Styria – Austria functions. The works of Li (2002) and Quesada (2011) have proven to be relevant for this study, as they analysed the contributions of various supply chain management factors to supply chain performance as well as the mediating role of supply chain performance in achieving competitive advantage. In order to test the research model, the authors created and distributed a questionnaire to obtain socio-demographic data on the respondents and their opinions (on a 5-point Likert scale) on 62 claims related to supply chain management factors. Forty two of the claims were taken from Li's questionnaire in 'A study of supply chain management practices, performance and competitive advantage' (Li, 2002) while the remaining 16 were formed based on the expert opinion of two experts in the field of logistics management and supply chain management. The questionnaire particles were formed in line with the regulations and recommendations for questionnaire design (Nunnally and Bernstein, 1994). Due to language and cultural difference, the Croatian questionnaire was back translated as not to disrupt the accuracy and truthfulness of the results. Some constructs were modified as they could not be literally translated and, as such, would not reflect their original meaning. The Croatian version of the questionnaire was pilot tested. The pilot included companies from wood clusters throughout Croatia. The data collected by the pilot test were also subjected to psychometric testing (validity and reliability).

4.2 Data collection

As the research included all Croatian wood clusters, the sample consisted of all companies operating within the clusters (164). The mailing list of companies was obtained from the government agency responsible for overseeing the work of clusters in Croatia (the Croatian Chamber of Economy) and through the RGFI javna objava – Fina portal, the public announcement portal of the Croatian Financial Agency (http://rgfi.fina.hr/JavnaObjava-web/prijava.do).

Table 1:

WOOD CLUSTERS IN THE REPUBLIC OF CROATIA

Name of the cluster	Number of members	Cluster type
*Drvni klaster Sjeverozapadne Hrvatske (*Northwest Croatian Wood Industry Cluster)	15	Operational clusters
Tehnointerijeri (Techno-interiors)	20	
Udruga malih pilanara PGŽ (Association of Small Sawmills of Primorsko-goranska County)	15	
Klaster drvnih prerađivača LSŽ (Wood Processing Cluster of Ličko - senjska County)	13	
Drvni klaster Zapadne Hrvatske (West Croatian Wood Industry Cluster)	4	
Drvni klaster Vukovarsko-srijemske županije (Wood Industry Cluster of Vukovarsko- srijemska County)	22	
Drvni klaster Virovitičko-podravske županije (Wood Industry Cluster of Virovitičko-podravska County)	6	
Hrvatski interijeri (Croatian Interiors Cluster)	10	
Proizvođači masivnog namještaja (Solid Wood Furniture Manufacturers)	6	
Zadruga Slavonski Hrast (Cooperative Society 'Slavonian Oak')	12	
Hrvatski klaster konkurentnosti drvno prerađivačkog sektora (Croatian Competitiveness Cluster for Wood Processing)	37	Advisory clusters
Drvni klaster Slavonije (Wood Industry Cluster of Slavonia)	4	
Total members	**164**	

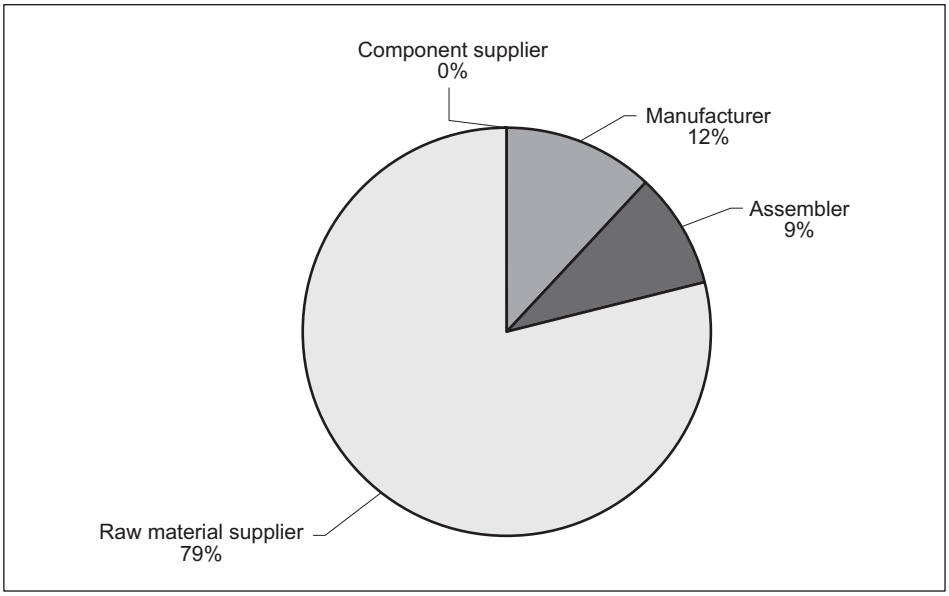
Source: Author (* English translation is provided in parentheses)

After defining the sample, the questionnaire was constructed using SurveyMonkey and was sent by email to companies accompanied with an explanation and description of research objectives. The respondents, who had not completed the questionnaires in the first round, were sent a reminder after three weeks to participate in the study by filling in the questionnaire and a network link to the questionnaire. The questionnaires were sent to companies three times over a period of two months. In order to achieve the greatest possible response rate, the data were automatically stored in a database intended for this purpose (to preserve

anonymity, the network service SurveyMonkeyTM automatically stored data on the respondents who have or have not completed the questionnaires). Out of the total number of surveyed companies (164), 54 questionnaires were received, which amounts to a 32.92% response rate. Upon screening, 20 questionnaires were found to be completed incorrectly and were eliminated from further analysis. Therefore, the final response rate of correctly completed questionnaires was 20.8% (34 questionnaires). After completing data processing from the questionnaire survey it was found out that the majority of companies or 79% are suppliers of raw materials, 12% of the companies are producers, while 9% are assemblers, and no component supplier took part in the research.

Figure 2:

ORGANIZATIONS BY SUPPLY CHAIN POSITION



Such a structure of supply chain is characteristic of Croatian wood cluster as most of Croatian clusters tend to interconnect businesses which produce products that require a lower degree of processing such as carpentry and sawmill. After the survey was conducted through questionnaires, the data obtained were processed.

4.3 Research results

The first phase in the processing of questionnaire data included establishing the psychometric characteristics of the second part of the questionnaire: validity and reliability. As the questionnaire had been altered (modified) from the original to meet language and cultural difference, a principal component factor analysis was conducted using Oblimin or oblique rotation (for reasons of the assumption of correlated factors). Validity was indirectly determined by determining the number of factors through: 1) the Cattell Scree test, 2) the Kaiser-Guttman criterion for reducing the number of main factors (only particles with Eigenvalues over 1 were taken into account), 3) the analysis of factor loadings, and 4) the analysis of the intercorrelation among factors. Particles with factor loadings <0.4 and / or particles that had an equal load on more than one factor were excluded from the questionnaire. The method of internal consistency, which involves determining the value of the coefficient of reliability Cronbach, was used to access questionnaire's reliability. The criterion for Cronbach reliability coefficient is $\alpha < 0.5$.

The factor loadings of the factors: the added value process, information technology, partner relationships (independent variables), supply chain performance and competitive advantage (dependent variables) are listed hereafter. The results of the factor analysis indicate that the value added process factor consists of two factors: production processes and process quality. The production processes factor consists of six particles (factor loadings of particles range from 0.52 to 0.86), while the process quality factor has two particles (factor loadings of particles range from 0.45 to 0.86). Factor loadings indicate that the information technology factor consists of three factors. Factor one -communication tools, consists of four particles (factor loadings of particles range from 0.65 to 0.83), factor of two -IT equipment, of two particles (factor loadings of particles are 0.83 and 0.84), while factor three - integrated information systems has four particles (factor loadings of particles range from 0.44 to 0.77). Based on the calculation of the factor loadings for the partner relationships factor shows that the factor relationships with suppliers includes six particles (factor loadings of particles range from 0.69 to 0.84), while the second factor, relationships with customers, consists of five particles (factor loadings of particles range from 0.42 to 0.76). The supply chain performance factor consists of three factors: supply chain integration, supply chain flexibility and quality of the partnership. Supply chain integration is described by 12 particles with factor loadings ranging from 0.69 to 0.91. The second factor, supply chain flexibility, includes 3 particles with factor loadings ranging from 0.47 to 0.84. The third factor, partnership quality, is described by 2 with factor loading ranging from 0.42 to 0.83. Competitive advantage is described by two factors: quality and price. The results of the analysis indicate that the factor of quality consists of 11 particles (factor loadings of particles range from 0.51 to 0.86), while the factor of price of three particles (factor loadings of particles range from 0.46 to 0.75).

Table 2:

RESULTS OF THE FACTOR ANALYSIS

	Item	FA1	FA2	FA3
Independent variable	Added value process			
	Eigenvalue	4,28	1,22	
	Variance explained (%)	47,50	13,62	
	Cronbach`s Alpha	0,866	0,578	
	Information technology			
	Eigenvalue	3,85	2,03	1,23
	Variance explained (%)	38,53	20,30	12,30
	Cronbach`s Alpha	0,73	0,70	0,55
	Partner relationships			
	Eigenvalue	5,22	1,26	
	Variance explained (%)	43,48	10,46	
	Cronbach`s Alpha	0,806	0,648	
Dependent variable	Supply chain performance			
	Eigenvalue	9,56	1,95	1,29
	Variance explained (%)	53,12	10,84	7,15
	Cronbach`s Alpha	0,95	0,64	0,53
	Competitive advantage			
	Eigenvalue	5,81	1,77	
	Variance explained (%)	41,47	12,62	
	Cronbach`s Alpha	0,899	0,531	

The next stage in the research included conducting a multiple regression analysis in order to determine the extent (share) and significance of the effect of investigated factors (added value process, information technology, partner relationships- independent variables) on supply chain performance and competitive advantage (dependent variables). The primary purpose of conducting the multiple regression analysis was to determine the intensity of the contribution of supply chain management factors in achieving competitive advantage in wood clusters. The effects were established by testing the correlation (r) and the contribution (R2) of the factors: added value process, information technology, partner relationships to supply chain performance and competitive advantage

The results of the analysis were aimed to determine the ability of the factors to statistically strongly contribute to supply chain performance, which confirms the possibility that the supply chain management concept contributes to business

system's efficiency. Moreover, the established link between supply chain performance and competitive advantage indicated the ability of the concept to contribute to the effectiveness of the business system.

Table 3:

CONTRIBUTING SHARES OF INVESTIGATED INDEPENDENT FACTORS

Factor	β	SE_β	P	r	Contributing share %
Value added process*	0,057	0,120	0,641	0,371	2,1
Information technology*	0,171	0,140	0,235	0,635	10,6
Partner relationships*	0,756	0,133	<0,001*	0,874	66,1

*Independent variables

The multiple regression analysis results indicate that the determined statistically significant multiple regression coefficient R = 0.888, (p <0.001) resulting in R2 = 0.788, which means that the total contribution of the investigated factors to supply chain management performance factor amounts to 78.8%. The determined contributing share of the value added process to the supply chain management performance is 2.1% and is not statistically significant (p = 0.641). The same applies to the (10.6%) contributing share of information technology (p = 0.635). The analysis shows that in Croatian wood clusters the only significant contributing share is that of partner relationships within the supply chain, which is 66.1% (p <0.001).

Table 4:

CONTRIBUTING SHARES OF INDIVIDUAL FACTORS

Factor	β	SE_β	P	r	Contributing share %
Business processes*	0,115	0,132	0,395	0,189	1,8
Business process quality*	-0,045	0,119	0,711	0,176	0,3
Communication tools*	0,186	0,175	0,306	0,333	4,0
IT equipment*	0,250	0,154	0,023*	0,449	5,2
Integrated information systems*	0,082	0,141	0,570	0,436	1,4
Suppliers*	0,638	0,187	<0,001*	0,896	57,2
Customers*	0,102	0,118	0,402	0,416	8,9

*Independent variables

Among all tested factors, the contributions found to be significant were that of IT equipment (5.2%, p = 0.023), and relationships with suppliers (57.2%, p <0.001). None of the other tested factors were found to be statistically significant for supply chain management performance. The last phase of regression analysis included calculating the contributing shares of supply chain performances (supply chain integration, supply chain flexibility and partnership quality) to competitive advantage. The results of the analysis are presented in Table 5

Table 5:

CONTRIBUTING SHARES OF SUPPLY CHAIN MANAGEMENT PERFORMANCE TO COMPETITIVE ADVANTAGE

SCM performance	β	SE_β	P	r	Contributing share %
Supply chain integration*	0,209	0,235	0,379	0,269	5,6
Supply chain flexibility*	0,090	0,179	0,616	0,005	0
Partnership quality*	0,128	0,229	0,579	0,251	3,2

*Dependent variables

A statistically significant multiple regression coefficient was not established R = 0.298, (p = 0.401) resulting in R 2 = 0.089, meaning that the overall contribution of investigated to competitive advantage is 8.9%. In Croatia, not a single factor describing supply chain management performance has proven to have a statistically significantly effect on competitive advantage, since p> 0.05 for all factors.

5. Discussion

5.1 Discussion of results

The obtained results of the statistical analysis and their interpretation are important and should be taken into consideration by current and future management strategies of wood clusters in Croatia. As there has yet been no referent research in the domain of the clusters analysing the implications of the implementing the concept of supply chain management on business performance, the obtained findings are of great importance. Their importance is primarily reflected in the (non) application of supply chain management factors and their effect on cluster's busi-

ness efficiency that is ultimately reflected in its competitive ability. The research results indicate the following:

The testing of hypothesis H1a and H1b indicates that the production processes factor does not strongly contribute to supply chain performance ($p = 0.395$; $r = 0.189$), and neither does the process quality factor ($p = 0.528$; $r = 0.378$). The refutation of hypotheses H1a indicates that companies have not yet managed to establish a common manufacturing process (manufacturing system), and that an appropriate system of quality has not yet been implemented within wood clusters. The establishment of manufacturing processes is an important basis for the implementation of lean management, which implies the implementation of various techniques to eliminate the losses within the supply chain. Lean management is mostly applied within independent companies in order to ensure efficient continuous processes requiring less human effort, less space, less capital employed and less time to produce a product or provide a service. This research has proven that there is a need for applying lean management in wood clusters in order to maximize the system's efficiency. These are useful notions that can be used by cluster managers in wood clusters in their analysis and selection of business strategies.

The testing of hypothesis 2 has proven that information technology does not significantly contribute to supply chain performance ($p = 0.235$; $p = 0.635$) and that there is a significant contribution of the pertaining IT equipment factor ($p = 0.033$). While investments in IT equipment are understandable as it shortens the time needed to execute processes and serves as a control mechanism for established processes, it is evident that the investments made by companies within clusters in communication tools and integrated information systems are insufficient. Noninvestment or insufficient investment in modern software solutions can be a serious problem in the long run as there is a noticeable trend of increased investment precisely in this segment of business organization in other industries. Nowadays, the programs gaining on popularity are those that involve all participants within the supply chain and are highly specialized in particular business segments (Chizzo, 1998; Hicks, 1997; Tan, 2001). As wood clusters do not fall into the category of technology-intensive industries, it is unrealistic to expect short deadlines for the changes of existing solution programs or to have frequent needs for system upgrades. Moreover, the implementation of a specific program requires significant financial means for their implementation and employee training. In some cases, the costs of maintaining and upgrading the program exceed the initial amount invested in its acquisition, which may discourage the management in their decision to acquire the program. Given that wood clusters consist of several companies in different stages of the process, it is evident that there is a need to make a well thought out decision that will ensure a long-term smooth integration of companies within the cluster, which is not simple, especially if you take into account the diversity of business systems.

Testing of hypothesis 3 has been proven that partner relationships strongly contribute to supply chain performance ($p = 0.001$; $r = 0.874$), primarily those with suppliers, whose contribution is statistically significant ($p = 0.001$), while the contribution of relationships with customers is not ($p = 0.402$). The greater contributing share of relationships with suppliers in wood clusters is expected since the production function of companies directly depends on the availability of raw materials and therefore companies put more emphasis on the procurement of raw materials. The dependency on raw materials is particularly pronounced in the Croatian wood processing industry due to limited number of supply channels (suppliers) and limited natural resources. On the other hand, the relationship with customers is primarily a marketing tool that allows organizations to gather more data and information about customers that will be used in the development of future sales strategies. The relationships with customers largely rely on software solutions that have been developed for the purpose database classification of collected data. The testing of the 3b hypothesis has proven that the contribution of communication tools and integrated information systems is not significant ($p = 0.306$ and $p = 570$) in clusters, which only reinforces the existing notions on the insufficient computerization of strategic alliances' business activities, which ultimately negatively affects the efficiency of joint production of the final product.

The testing of the fourth hypothesis has proven that supply chain performances do not contribute significantly to competitive advantage ($R = 0.298$, $p = 0.401$). The same was found for factors describing supply chain performance. Supply chain integration and partnership quality contribute with only 5.6% and 3.2% respectively, whereas supply chain flexibility does not contribute at all (0%) to achieving competitive advantage.

The refutation of the hypothesis number 4 represents the backbone of this research as it has been established that supply chain management has not fully been implemented in the management system of Croatian wood clusters. The lack of effects of supply chain performances on competitive advantage indicate that the value added process, information technology, and partner relationships do not have a significant effect on their efficiency as well as their effectiveness. As factors describing supply chain performance (supply chain flexibility, supply chain integration and partnership quality) statistically do not contribute to competitive advantage, it can be concluded that the application of the supply chain management concept is in the initial stage. This indicates that clusters in Croatia are established based on geographic criteria, and that a functional connection of members has not yet been achieved.

The above insight is important because Croatia has currently great unused potential which, if not put into function, will result in further impoverishment and decline of the entire wood industry. The reason for this lies in the transition

or change in management paradigms. Namely, the wood industry had been centralized until 1995 and distributed among 60 *kombinats*, while today, there are over 600 small manufacturers who account for 90% of economic entities. In the course of changing the social system transition, Croatia took over models from Western countries (e.g. the Styrian cluster), but unlike Croatia, Austria has had over 60 years of experience in developing its wood industry in a market economy environment, which resulted in achieving a superior competitive advantage over its neighbouring (Poland) and remote competitors (China).

One of the primary factors affecting the strong competitiveness of the Austrian model is the interconnection of entities into vertical clusters in which each manufacturer / distributor is a link in the chain whose competence/specialty contributes to supply chain's integration and flexibility. Moreover, unlike the operational clusters in Croatia, which are, on average, made up of 12 members, the Austrian cluster consists of 156 companies, suggesting that the cluster has successfully implemented a management system capable of achieving simultaneous integration and flexibility of the overall system. Furthermore, unlike Croatian clusters, the Austrian cluster in addition to the geographic dimension incorporates, more importantly, the functional dimension which enables its members to cooperate mutually and through joint work contribute to advantages arising from contemporary theories on clustering (innovation, flexible specialization and economy of scale). The Austrian model can serve as a benchmark to Croatia and other transition countries in designing and defining the concept of wood cluster management as the existing models insufficiently exploit the advantages to be gained by functional connectivity and by implementing the concept of supply chain management.

5.2 Contribution to theory

The conducted research contributes in several ways to the broadening of existing theoretical knowledge on the possibilities of implementing the supply chain management concept in wood clusters.

Firstly, the research results are important for wood industry clusters as almost no research so far made a distinction between the significance of functional and geographic dimensions of clusters in transition countries. In order to prove the significance of each of these dimensions, the Croatian wood clusters were analysed. The research found that Croatian clusters are established according to the geographical dimension and that the level of functional interconnectivity between members is not very high. This business philosophy has so far resulted in short-term lowering of business competitiveness and in the long-term period, their shutting down.

Secondly, the literature states that the functional dimension defines the modality of the interconnection between cluster members, but nowhere does it explicitly state the role occupied by the supply chain management concept. The results of this research indicate that supply chain management is an important determinant of the functional dimension of clusters and it is of great significance for achieving competitive advantages of wood clusters.

Thirdly, the contribution of partner relationships to cluster performance is statistically relevant, while information technology and the value added process are not. It has also been found that supply chain performances do not contribute to the competitive advantage of wood clusters which is an indication of an ineffective application of the concept in wood clusters. None of the supply chain performance factors (supply chain flexibility, partnership quality and supply chain integration) has proven to be statistically relevant for the competitive advantage of wood clusters.

Fourthly, in the future, the research model may serve as a reliable tool for evaluating the achieved level of the implementation of the SCM concept in wood industry clusters, and as a tool for benchmarking with other cluster initiatives that have successfully implemented the concept of supply chain management in their business. Today, business analysis most commonly uses different business indicators (inventory turnover, cost of holding inventories, average time of delivery, reliability of delivery, speed of shipment of goods, etc.) focused on metrics. However, the results of this research indicate that *soft* indicators (variables of the model) are also of great importance in business analysis.

Fifthly, the results indicate that wood clusters in transition countries ought to be restructured in a way to increase the share of information technology and value added process which would lead to process connectivity between members, or in other words, the establishment of a value creation chain which is essential for market survival and future growth. Currently, the clusters in transitional countries are selling low-differential products and cannot compete with clusters from the West (Austria and Italy) that have successfully been implementing the SCM concept and are as a result of it producing higher value added products.

5.3 Implications for practitioners

The research results have practical application as well. They may primarily be of use to cluster managers in Croatia and other transition countries in the planning and organization of clusters in wood industry, as well as to managers managing some other form of strategic alliance. Given the past and current strategies, policies, measures and management practices in Croatian clusters, the results can

serve also as a useful indicator to strategic decision makers in opting for alternative directions in developing clusters in Croatia. A strategic change in cluster management implies abandoning current practices that advocated formal establishment of cluster without process integration (joint production of goods and services) or horizontal integration. That business model does not lead to the realization of competitive advantage; the members within the system are not producing market-competitive products clearly indicating that there is a need for incorporating supply chain management in designing clusters. Namely, it has already been proven that the SCM concept largely contributes to the generation of positive economic effects (Wood Cluster Styria).

5.4 Research limitations

This research has significant theoretical and practical implications, but also certain limitations, primarily due to the current limited use of the supply chain management concept in Croatian wood clusters.

First, the pilot study has found that the factor *top management's support in applying the SCM concept* is not statistically relevant in the analysis of Croatian wood clusters. Top management's support to the SCM concept was not identified in the pilot study which included factor analysis and expert opinion. Justification can be found in the fact that clusters in Croatia are predominantly based on geographical connectivity between members, and the respondents do not perceive the functional dimension and the role of supply chain management in clusters. According to experts, the effects of supply chain management in Croatian wood clusters have not yet been researched and therefore, it is assumed that the respondents are not familiar with the concept of supply chain management which has certainly affected the outcome of the survey. By not determining the significance of managements' support to supply chain management, the contribution of the main driver in Croatian wood clusters was also undetermined which needs to be taken into account in defining similar studies.

Second, the analysis within this research was carried out on Croatian wood industry clusters, which may be a rather small sample for the results to be considered relevant for clusters in other transition countries. In the future, it is necessary to conduct a similar research to include clusters from Slovenia, Bosnia and Herzegovina, Serbia, Romania and Bulgaria in order to obtain more precise results on the implementation of supply chain management in wood clusters. More precise results are necessary in order to form conclusions on which to develop the strategy of wood cluster management.

Third, as the respondents included by the survey are individuals active in single business segments within the supply chain (procurement, sales, production, etc.) and as some of the claims in the questionnaire applied to the entire supply chain (integrated information system, business processes, supply chain performance etc.) the reliability of investigated factors is somewhat reduced.

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ANALIZA UTJECAJA ODABRANIH ČIMBENIKA MENADŽMENTA OPSKRBNOG LANCA NA POSLOVANJE DRVNIH KLASTERA U REPUBLICI HRVATSKOJ

Sažetak

Svrha ovog rada je utvrditi značaj koncepta menadžmenta opskrbnog lanca u drvnim klasterima u Hrvatskoj kao tranzicijskoj državi, odnosno istražiti vezu između informatičke tehnologije, odnosa s partnerima, procesa dodavanja vrijednosti i performansi opskrbnog lanca te vezu između performansi opskrbnog lanca i konkurentske prednosti članica klastera. Istraživanje je provedeno na 20,8% poduzeća u drvnim klasterima Republike Hrvatske. Najprije je provedeno anketno istraživanje, a zatim su prikupljeni podaci podvrgnuti faktorskoj analizi kako bi se utvrdili faktori koji opisuju čimbenike menadžmenta opskrbnog lanca. U posljednjoj fazi izvršena je višestruka

regresijska analiza kako bi se testirao doprinos čimbenika performansama opskrbnog lanca i doprinos performansi opskrbnog lanca konkurentskoj prednosti. Istraživanjem je utvrđen samo odnos s partnerima kao statistički relevantan, dok doprinos procesa dodavanja vrijednosti i informatičke tehnologije nije. Izostanak dvaju važnih čimbenika sugerira da članice klastera nisu funkcionalno povezane već da su klasteri primarno uspostavljeni po geografskom načelu. Stečena saznanja sugeriraju da je potrebno promijeniti upravljačku paradigmu u Hrvatskim drvnim klasterima, odnosno staviti veći fokus na funkcionalnu integraciju članica umjesto na geografsku povezanost koja je još uvijek dominantno zastupljena u tranzicijskim državama kao osnovni kriterij uspostave klastera.

Ključne riječi: drvni klasteri, menadžment opskrbnog lanca, konkurentska prednost, funkcionalna povezanost