

VIRTUAL SUPPLY CHAINS AND THEIR APPLICATION IN BUSINESS: EXAMPLE OF POLAND

Ieva Meidutė¹, Michail Litvinenko², Algis Budzejko³

^{1, 2, 3} Vilnius Gediminas Technical University, Faculty of Business Management,
Saulėtekio ave. 11, LT-10223 Vilnius, Lithuania

Emails: ¹ieva.meidute@vgtu.lt, ²michail.litvinenko@vgtu.lt, ³algis.budzejko@gmail.com

Abstract. New technologies and business models, that are applied, lead to sharp changes in the activity of most companies. Their adaptation to changing business conditions could become a company's guarantee of success in a competitive environment. In order to increase the competitiveness, companies are looking for ways to optimize logistic processes; therefore, the adaptability of electronic solutions is gaining more attention. It comes as no surprise that companies are trying to transfer traditional logistic activities into a virtual space. Considering the fact that e-logistics is still a relatively new branch of science that requires further investigation, the primary focus of the present article is on the links between e-logistics and e-business as complementary elements vital for modern business. Moreover, various scientific approaches to the virtual supply chain, which belongs to one of the major operating media of e-logistics, are discussed. The article also presents the results of the research which reflects the real situation in tire and rim sales market in Poland, where virtual supply chains are applied.

Keywords: e-logistics, technology, supply chain, distribution chain, virtual, e-business, model.

Jel classification: M10, M11, M15.

1. Introduction

In recent years, e-business has become an integral part of business that was influenced by the fact that more e-business technologies and solutions have been implemented in the activity of most companies. Such changes have also been detected in logistics processes of the companies which are looking for ways to optimize logistics processes and achieve more effective economic objectives by applying the latest scientific developments in order to increase competitiveness. According to Chin *et al.* (2010), the successful implementation of supply chain management both directly improves performance and indirectly increases customer satisfaction and financial indicators. It has been noted that the effective supply chain management improves business productivity and reduces costs, thus becoming one of the company's key to success. The goals mentioned above could be achieved by implementing e-logistic processes.

However, as Kisperska-Moron (2010) has argued, the main problem encountered is the fact that the current use of virtual supply chains is not always possible and appropriate. Mulinski ir Sachs (2009) have emphasized that there are certain factors and natural organizational processes that prevent the use of virtual supply chains and hinder their integrity.

Considering the fact that e-logistics is still a relatively new branch of science that requires further research, the present article aims at investigating the application of virtual supply chains in tire and rim business in Poland. In order to achieve the aim mentioned above, the scientific literature review and qualitative research, according to the results of which the conclusions were drawn, have been carried out.

2. E-business relation to e-logistics

The development of the Internet has created favourable conditions for customers and sellers to find each other in cyberspace. Yet in 2008, Cho *et al.* have noted that logistics functions performed have changed in parallel with e-business (Cho *et al.* 2008). According to Placzek (2010) and Talluri (2000), the appearance of new technologies has led to the development of e-logistics services and their use in existing business. Kisperska-Moron (2010) believes that the further development of e-business processes is one of the key factors stimulating the interest of the companies in e-services (including e-logistics) and their implementation in practice.

In order to identify the areas of activity related to e-business and e-logistics, it could be useful to consider the opinion of Davidavičienė *et al.* (2009), according to which, e-business is more than the sale of products and services online, as it includes internal business processes, i.e., e-business is a comprehensive concept that includes e-commerce and other e-services; at the same time, Kisperska-Moron (2010) has emphasized that e-logistics activities are designed to optimize the supply chain through e-business processes. According to her, the optimization method includes electronic procurement, warehousing and distribution management as well as strategic planning and the implementation of further development.

E-services related to logistic processes, used by companies in supply chains, require numerous electronic tools belonging to various service areas, i.e., e-procurement, e-manufacturing, e-commerce, e-logistics, e-marketing, and etc. (Barcik, Jakubiak 2010; Davidavičienė, Meidutė 2011). According to Barcik and Jakubiak (2010), companies that operate in a virtual environment (integrating e-business in their activities) could achieve higher productivity and discover new markets. Scholz-Reiter, Hohns (2003) and Zak (2005) agree with the opinion mentioned by stating that e-logistics is an integral factor in the successful development of e-business. E-logistics services support the operation of supply chains and have nothing to do with the physical flow of the products, vehicle ownership or storage (Zhang *et al.* 2009); in other words, these are virtual processes which are required in order to deliver the products purchased online to the purchaser (Pires, Sacomano 2008).

3. Virtual supply chain relation to e-logistics

Papakiriakopoulos ir Pramadari (2010) have noted that the virtual supply chain is a tool for information exchange related to logistics functions of electronic, systemic or integrative nature, using computer technology. Gunasekaran and Ngai (2007) have defined the virtual supply chain as a virtual form of integration linking customers, suppliers and marketing network partners. Analysing virtual organizations, Stankevičienė and Dudėnienė (2005) have emphasized the fact that the development of worldwide communication and transportation systems, which enables the global sales and the search for global resources, is one of the main trends in the formation of virtual organizations. They have also pointed out that the competitiveness of the virtual organizations depends on the rapid creation of new productive resources. According to Mulinski ir Sachs (2009) bei Thakkar *et al.* (2008), the number of companies applying logistics in e-business is growing. Virtual supply chains are becoming increasingly popular as they are able to ensure greater flexibility for companies than traditional ones. Mulinski ir Sachs (2009) has argued that the implementation of modern information technology makes it possible for organizations to create certain solutions that are used in logistics activities. Changes resulting from the transformation are affecting the entire supply system: from ordering time to the product delivery (Placzek 2010).

4. Virtual supply chains operating principle

According to Kisperska-Moron (2010), it is highly important both to identify the basic mechanisms governing the virtual supply chain operation and, what is more, to decide whether the company is ready to use such distribution chains. Mulinski, Sachs (2009) bei Angeles and Nath (2007) have argued that the current use of virtual supply chains is not always possible and appropriate. According to Gunasekarano *et al.* (2007), virtual supply chains unite companies only periodically, considering certain tasks, common objectives, values or actions. The chain should be appointed on a temporary basis only, in order to perform a specific task, after the implementation of which, it disintegrates, participates in other networks, or connects the new ones.

According to Placzek (2010), the appearance of the concept of the virtual supply chain has been determined both by the development of the communications and information processing technology and by the idea related to product design at certain industrial sectors, i.e., at the business areas where a direct link between the user and the producer exists. Customer orientation is not a feature of the virtual supply chains only; however, a virtual supply chain is created in order to meet the needs of a particular client and perform a certain task. Moreover, the client could actively participate in the task.

According to Kisperska-Moron (2010), the use of information technology eliminates all barriers to cooperation between the separate units at a certain dis-

tance away. Hence, the virtualization of supply chains is considered as “overcoming spatial barriers”. The operation of virtual supply chains does not depend on the distance: as information technology (IT) is used, the entire operational process is related to the technology used, the equipment applied, the complexity level, and etc. (Williams *et al.* 2002).

Wang *et al.* (2007a, 2007b) have argued that virtual supply chains usually have a networked structure with no hierarchical dependencies; i.e., it is a dynamic structure with one coordinating unit performing the main activities. The cooperation between the individual participants of the chain is based on the fixed contracts. Partners are selected according to their core competencies which could be applied in certain kinds of tasks as well as in delivering the product to the customer (Davidavičienė, Meidutė 2011). In order to ensure the highest quality, chain participants are selected according to their competencies (skills and knowledge). Each action, or process, could take place globally, which would be difficult to achieve in traditional distribution channels (Gunasekaran *et al.* 2007).

As seen from the perspective of the client, the virtual supply chain is considered a single entity rather than a set of small organizations (Kisperska–Moron 2010). The main advantages of the employment of the virtual supply chains are: their flexibility, adaptability to changing situations and ability to develop synergetic potential; which guarantees the minimization of costs, maximization of the service speed and improvement of the quality (Mehrjerd 2009). Other advantages of the virtual supply chains that are mentioned in the scientific literature (Meidutė *et al.* 2012; Kisperska–Moron 2010; Gunasekaran *et al.* 2007) are the following ones:

- the optimization of the value in the chain (e.g., production and distribution);
- the enhancement of the performance and the reduction of costs;
- the potential in saving time and the increase in leeway.

However, the use of virtual supply chains is associated with the following disadvantages:

- the abuse of power and arbitrariness;
- the problems related to employees’ identification;
- the problems related to signing the short-term contracts with influential partners;
- the difficulties related to income distribution and development (when it comes to cooperation) (Daugherty 2011).

Cooperation between the supply chain participants is the key of the supply chain management to the company’s success (Ballou 2007, Mehrjerdi 2009, Daugherty 2011).

After the scientific literature review has been carried out, it could be stated that e-logistics is an integral part of e-business, partly influencing its development. Virtual supply chains are involved in all e-logistics processes. Proper use of virtual supply chains creates favourable conditions for cooperation between business partners and business units involved in the product distribution channel.

5. The research on the application of virtual supply chains in tire and rim business in Poland

5.1. Research methodology

Due to the establishment of new companies, the market of rims and tires becomes congested; therefore, it is highly important to find new solutions in order to stay competitive in this business area. This research identifies the key problems related to the practical use of the virtual supply chains.

In order to determine the applicability of the virtual supply chains in the sector of rims and tires, two types of research have been carried out, i.e., primary and secondary.

At the stage of the primary research, the market research has been carried out; whereas, at the stage of the secondary (qualitative) research, the aspects related to the application of the virtual supply chains in the business sector of rims and tires have been identified.

5.2. Secondary data analysis

The present research is aimed at evaluating e-business prospects in the business sector of rims and tires in Poland. In this research, the secondary data, i.e., the results of other researches and the data provided by the Department of Statistics, is used. The research is particularly important as it allows evaluating the real opportunities of the development of e-business; in addition, it provides a certain basis for secondary analysis.

Analysing the general situation, according to the data collected by the Department of Statistics, approx. 54.4% of the companies had web pages or websites in 2010. In the period from 2005 to 2010, the number of companies having web pages, or websites, has increased. In 2010, the largest number of websites belonged to the companies operating in business areas related to computers (87%), mail and telecommunications (83%) and financial mediation (82%). Electronic networks for trade (i.e., to buy or sell products and services) were used by 31.8% of the companies. 26.7% of the companies have purchased (ordered) products, or services, online; 22.9% of the companies have received orders.

The results of the survey provided by the *stat.gov.pl* and EUROSTAT have showed that, on average, one in two companies (mainly service companies) have their own website; however, one in ten companies trade online. One in five companies (19.9%) purchase online (in B2B sector).

According to the survey carried out by the Statistical Office of the European Communities (EUROSTAT), approx. 10.8% of the persons (of all age groups: from 16 to 74) with the access to the Internet used e-commerce services for private purposes in 2010.

The *stat.gov.pl* has carried out the survey in order to analyse 398 e-shops operating in the Polish market. According to its results, approx. 17% of the e-shops use

at least one service provided by the external companies when implementing orders and the rest 87% of the e-shops operate individually. 25% of the e-shops operating in the Polish market do not have their own warehouses; such companies usually use logistics outsourcing, i.e., all the logistics services are entrusted to other companies. 22.48% of the companies exploit their e-shops as the only channel for the distribution of goods. 30% of the companies use their e-shops as an additional distribution channel for only a certain part of the assortment. Almost one in two companies (47.47%) use their e-shops as an additional distribution channel for their assortment. The survey has showed that only 7.83% of the manufacturers sell their products directly by their e-shops. 54.4% of the products are sold by the e-shops of the intermediaries.

After the secondary data analysis has been carried out, it could be assumed that the development trends of e-business are positive. More and more people rely on e-commerce, which encourages companies to develop their activities in this direction; therefore, the number of webpages and online stores is growing every year. E-commerce is often used as the main distribution channel which normally sells the assortment of the intermediary. Some companies use additional services of the external companies; and almost one in four companies do not have their own warehouse.

The analysis of the secondary data does not present the precise information required to solve the research problem; however, it could be used as the basis for further investigation. In order to verify the results of the analysis and widen the range of information regarding the problem in question, a qualitative research, the in-depth interview, has been carried out.

5.3. The in-depth interview and its results

The present research is aimed at identifying whether the virtual supply chains are used in the business sector of rims and tires in Poland.

Research objectives:

- the evaluation of the situation in the business sector related to rims and tires: primary research results verification;
- the identification of the distribution channels used and formulation of the potential problems and solutions/suggestions to eliminate the problems;
- the evaluation of the level of the adaptability of the companies to e-business environment;
- the evaluation of the applicability of virtual supply chains in the business sector of rims and tires.

The in-depth interview has created an opportunity to get detailed and substantive answers to the questions raised. The sample size was determined employing the method of the decreasing information flow.

The answers of the respondents are presented in a summarized form.

At the initial stage of the survey, the general questions were asked in order to

define the market of rims and tires in Poland. It was tried to learn about the business of rims and tires, its current opportunities and future prospects in this part of the research. Further questions were related to the distribution channels used by the companies, the processes taking place at different stages of distribution, relations between the business units cooperating in the channels and the key challenges in the distribution of channels in those companies.

All respondents have emphasised the fact that the business sector of rims and tires is developing rapidly. A noticeable increase in sales, related to the growing number of companies selling rims, has been detected. As the respondents predict, this trend will continue to stay positive. It has also been noted that the market is overloaded with goods; thus, small companies, as well as start-up ones, are encountering the difficulties in entering the market. *The answers of the respondent have confirmed the secondary data results.*

The respondents have noted that the number of e-shops selling rims has increased. According to them, there has been a rapid rise in this number during the past two years. This fact could be related to the importance of satisfying the client's needs: more and more people are using e-commerce. According to the retail companies, e-commerce, being one of the main (primary or additional) sales sources, plays an important role in their business.

The respondents have also mentioned that their e-shops could only offer the assortment of the products they are having in their stocks, which is related to the fact that the suppliers provide products in large quantities, as there is no generally accepted ordering scheme according to which smaller quantities of goods could be delivered (i.e., the transportation costs for a single order are high). The respondents (the retailers) have identified the issues listed above as a problem. It would be more favourable to them if they succeed in aligning the transportation costs with the quantities of the products delivered.

The research results have shown that the wholesalers, cooperating with the manufacturers directly, are playing the leading role in the rims distribution channel. The manufacturers are "indifferent" to the distribution channels through which their goods are delivered to the end user; hence, this function is entrusted to the wholesalers, which are responsible for regulating the entire distribution channel (the selection of marketing partners). The wholesalers, usually representing only one manufacturer, often work separately. The product sale to the end user is usually operated by the retailers (e.g., various types of commercial and service companies), or directly, i.e., without retailers. The retailers have their own regular suppliers whereas the wholesalers have their regular clients; thus, as the respondents have noted, a closed circle is formed.

The research has revealed the fact that communication between the wholesalers and retailers is implemented in a variety of ways, however, usually by phone or e-mail. The product ordering is implemented in the same way. The retailers consider this way of communication very inconvenient and time-consuming; however, the wholesalers rarely use automated ordering systems. The

respondents (the wholesalers) have admitted the necessity of such systems but also indicated the problems considering their implementation (e.g., high costs related to system installation and etc.).

According to the respondents (the retailers), they use the services of other companies (e.g., transportation and lending companies, banks, and etc.) when dealing with ordering or selling products. The necessity to work with each such company, using its own system, “individually” is considered the main disadvantage related to the cooperation with such companies. The respondents have identified the possibility to provide all the services required at one place as an advantage; however, the problems associated with the implementation of the solution mentioned and the costs related to it appears. They have also mentioned the ability to use the warehouses of other companies (of the wholesalers) among the advantages listed; yet the problem related to such use exists: it would require some adaptation to transport small quantities of products, which is not possible for certain wholesalers. The research results have shown that the wholesalers approach the problem mentioned above in a positive way: they are looking for the possible solutions (e.g., the reorganization of the warehousing and dispatch sectors). All the issues mentioned could be determined according to certain forms of cooperation between the retailer and the wholesaler. The wholesalers have also discussed the possibility of cooperation; however, not all of them have supported that idea. The increase in the number of new clients has been identified as a positive aspect of such cooperation. On the other hand, some of the respondents could not indicate the possible (financial) benefits of such cooperation; moreover, they have doubts regarding the stability (i.e., the management) and technical feasibility (i.e., the common system) of the cooperation.

To sum up, the research carried out has proven the fact that the majority of the companies are ready to adopt innovations in order to improve their delivery systems; on the other hand, some of the companies are not ready for such changes. Hence, it is highly important to evaluate the delivery system in order to reorganize it properly (Mulinski, Sachs 2009; Angeles and Nath 2007).

6. Conclusions

1. E-logistics services support the functioning of supply chains; they have absolutely nothing to do with the physical flow of the products, warehousing, or vehicle ownership.
2. The use of the virtual supply chains is not always possible and appropriate; therefore, the identification of the company’s compliance with certain criteria, allowing them to operate in virtual supply chains, is one of the relevant contemporary research issues.
3. The main advantages of the employment of the virtual supply chains are their flexibility, adaptability to changing situations and ability to develop synergetic potential. A virtual supply chain is created in order to meet the

needs of a particular client, or perform a certain task; it is appointed on a temporary basis only to perform a specific task, after the implementation of which, it disintegrates.

4. The secondary data analysis has shown that the development trends of e-business could be considered positive in Poland. More and more people rely on e-commerce, which encourages companies to develop their activities in this direction.
5. E-commerce is often used as the main distribution channel which normally sells the assortment of the intermediary. Some companies use additional services of the external companies.
6. The results of the qualitative research carried out have shown that the business sector of rims and tires is developing rapidly. The majority of the companies use e-commerce as their main distribution channel.
7. After the evaluation of the supply chains currently used in the companies has been carried out, the following improvement could be proposed: the supply chain could be redesigned into a virtual one, with all data exchanges being automated, which would simplify the process of the physical movement of the products within the distribution chain. Such solution would be favourable for all participants of the distribution channel.

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