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Supply chain – a key factor of the sustainable development of city centers

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ABSTRACT

In the paper importance is given to the organization of the supply chain for a more efficient delivery of goods to city centers. Logistics activities are closely related because they depend on each other. The ultimate goal is to bring the product/goods to the end customer/consumer as soon as possible, on time, at the lowest cost, in perfect condition and in the appropriate quantity. The mutual coordination and cooperation of all participants in the supply chain can result in a satisfied end-user/customer. The development of information – telecommunication technologies – will greatly affect the future development and efficiency of the supply chain by finding new transport solutions that would mostly affect city centers. The paper mostly emphasizes the context of the delivery conditions in Rijeka's city center with a proposal for the location of a future centralized distribution center.

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1 Introduction

The importance of the supply chain is constantly evolving in different branches. In many industries, the task of logistics is to optimize production and distribution processes. The goal of logistics is that a certain product comes to the end customer as soon as possible, at the lowest cost and in proper condition and quantity. In the whole process of the supply chain, transportation is the key factor of successful business, from production to the delivery of goods to the end user or customer. Only effective mutual coordination and cooperation between all participants in the supply chain achieve a result that satisfies the end customer. In this way, successful business and trust coupled with a high level of service, is created.

The role of the supply chain is analyzed in this article for the area of the city of Rijeka on the basis of data collected through a detailed survey among all business users who use the delivery service in the city center. It is estimated that an organized delivery system affects the satisfaction of end users, but it can also significantly affect the sustainable development of the city center and improve the quality of life of citizens who live or work in the city center. In this way, organized transport services can significantly affect the quality of life, reduce traffic bottlenecks

in critical parts of the days, and therefore have a positive impact on reducing emissions of environmentally hazardous gases.

2 Parts of the supply chain

An interconnection of all participants in the supply chain will flow from customer satisfaction. In order to achieve a successful business, it is essential that every company is supplied on time with necessary goods and information and all at minimal cost.

The entire process takes place through two key components. The first of them is the management of materials that depend on the production process itself, where the intention is to manufacture a specific product from various raw materials, supplies and semi-finished products. The second component of the process is the distribution of products that takes place through the warehouse or logistics distribution centers, where goods are sorted and distributed to the customer, or end user.

The functionality of the supply chain is realized by the common interest of production and distribution where it should not be taken into account whether the executor of services is a manufacturer, or a specialized company, but

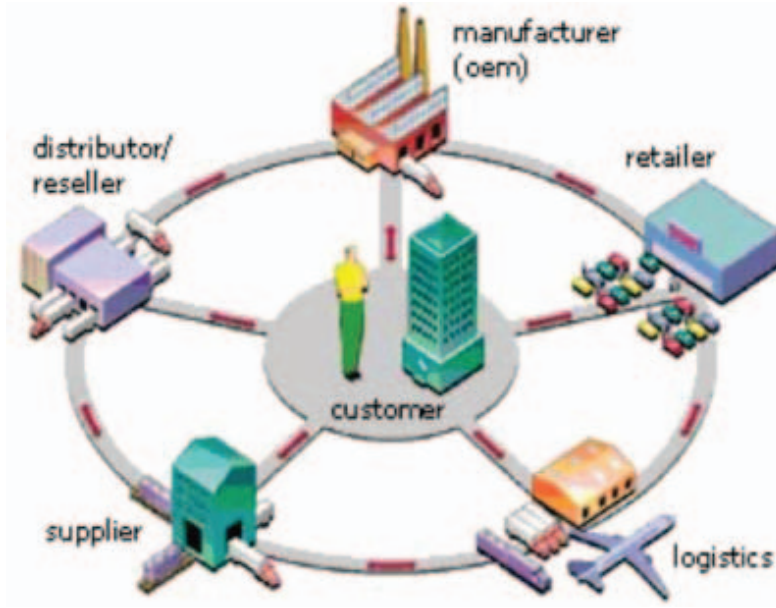


Figure 1 Supply chain

Source: <http://onlinemba.com/supply-chain-management-mba/> (02.06.2016)

the participant who will do the process fastest, most effectively, and at the highest quality. The objectives of distribution are that the product should be available as quickly as possible to the actual and potential consumers, with adequate distribution channels, least cost, and fast and accurate feedback. The whole process requires a correct selection of logistics distribution channels, with special attention paid to each product due to its specific characteristics (perishability, standardization, unit price and purpose of use). A logistics coordinator accelerates the success of distribution. Further, the logistics coordinator, or coordinating team, gets input about the demand for goods from the distribution center or from the buyer. Depending on the degree of automation, the input can be received monthly, weekly or on daily basis. [1]

The task of the logistics coordinator is to prepare dispatch plans on a weekly and monthly basis which depend on sales predictions, actual sales and information delivery. An important part of a logistics operator’s job is to get information from carriers about available transport capacities in order to distribute goods to end users quickly and without difficulty. For efficient services, it becomes necessary to have an elaborated information system which includes modeling, timely decisions-making and, what is also very important, answers to questions relating to the monitoring of the product. Such a system must have the latest information and offer corresponding solutions for every step between logistics services and transport stations.

3 The relation between transport and logistics

Without a quality-developed transportation system, logistics would not be able to realize its advantages in the overall process. A well-organized transport system of logistics activities can be seen through efficiency, the reduction of operational costs and the quality of services. The development of a transport system cannot be realized by itself but requires the efforts of the public and private sectors. The transport system is the most important component of the logistics system. Almost a third of logistics costs are attributed to transportation and this is evident from Figure 2.

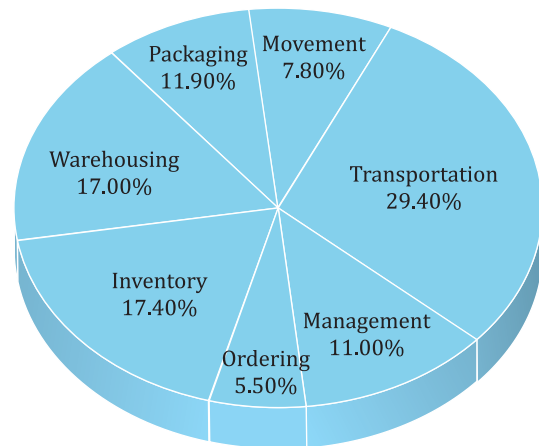


Figure 2 Costs in supply chain

Source: made by authors to: <https://www.siam.org/journals/plagiarism/1657.pdf> (24.02.2016)

3.1 Transport logistics network

Changing demands and environments have made from logistics a competitive tool to improve the quality of service for end users. A consequence of this, as well as a byproduct of competitiveness, is the reduction in total costs of services for users. The changes require daily basis browsing and the redesign of various logistics systems and tools used by participants in the supply chain. In order to define the logistics network, first of all a qualitative analysis should be made that is related to services which will be offered to customers. This includes the availability of the product itself, service of monitoring products, the accuracy of orders and the answer to the question of whether the customer has received the goods in their original condition. The untroubled transport of products to various imaginary places is achieved by quality decisions about accommodation units at locations such as warehouses, terminals and shops, in order to perform the best quality transport task. It is necessary to think about the quantity of supplies and their complementarity for each single place, so that the transport of goods proceeds without obstacles. The organization of transport depends on the mode of transport, the means of transport required by the client, the imaginary path to the respective final destination, the availability of the means of transport and most importantly, the type, quantity and characteristics of the cargo, which needs to be transported. [2] The tendency of logistics is to harmonize all of these components; a very demanding and complex job.

3.2 Transport and logistics activities

The only thing that the end user is interested in is to get the goods on time in proper condition and the ordered quantity. When planning the transport of goods to the end user, the intention is that the transport of goods is highly efficient with minimal cost yet delivering the best possible service to the end customer. Many companies involved in different activities, such as manufactures, warehouses, retail, purchasing, etc., are involved in the transport of goods. All of these activities require transportation services so that all processes proceed smoothly. Production requires the supply of raw materials, consumer materials and the like, which requires the organization of an other means or special form of transport. The transport of finished goods from the manufacturing plant to the warehouse or end customer, as well as from the warehouse to the end customer, also requires a good organization of transport and the use of multiple transport sectors, whether we are talking about combined, integrated or multimodal transport. From the above it can be concluded that the organization of transport between the various logistics activities is much more complex than just caring for the customers product. For a quality transport channel it is necessary to have quality management manifested through an efficient service to customers and as a bypass between producers and end consumers. For all of the above it is necessary to

constantly invest in information – telecommunication infrastructure – so that the whole process can be carried out without obstacles due to prompt and accurate data and information gathering.

4 Logistics as a tool for sustainable development of city centers

City logistics can be defined as the process of optimizing the logistics and transport activities of individual companies in an urban area, respecting traffic, environmental and energy factors, and the respective organization of existing urban transport mechanisms in place, in order to meet certain criteria. [6]

Logistics services in a city should ideally offer high quality and reasonable delivery service costs even within urban centers. The increasing development of cities represents a challenge to logistics operators in finding optimal solutions through continual investment in information –telecommunication technologies. The energy efficient transport of goods is necessary for the sustainable development of cities and should tend to balance economic growth with quality of life in urban areas. The concept of city logistics tends to develop and implement measures to achieve an efficient and ecologically acceptable urban transport system. The planning and management of urban transport is necessary for mobility, sustainability, and for life in the city itself, which includes reduced transportation costs and setting a higher level of logistic services in order to ensure that a city aims to be cleaner and quieter; thus representing improved security and positively influencing the quality of life of its citizens. The problem is very often that suppliers in the city center completely ignore and do not respect the prescribed and agreed locations of delivery. Vans and pick-up vehicles are increasingly used for the distribution of goods in urban centers because of the difficulty in accessing certain urban areas, small supply orders and an increase in the frequency of deliveries. City transport emits about 23% of CO₂ whereby a quarter of this relates to the transport of cargo alone. [7] This data should make it abundantly clear and motivate all participants in the supply chain, as well as all others that it serves, that it is essential to invest in new technologies to facilitate efficient service and satisfaction, alongside quality of life, in urban areas.

4.1 Consolidation of goods in distribution centers

Urban distribution centers have the basic principle of consolidation or connection of goods. This concept has always existed in one or more forms due to the constant growth of cities. To increase the efficiency of the entire distribution system it is necessary to connect the goods in various ways in a single unit. The concepts of connectivity can be carried out according to the time of delivery, according to the type of cargo, according to the route and by type of storage. The purpose of the consolidation of cargo is the regrouping of goods in larger quantity units in a way that these goods are close to suppliers and thus minimize



Figure 3 The position of the urban distribution center

Source: <http://www.research.softeco.it/cedm.aspx> (01.03.2016)

the cost of transportation and storage costs. As for transport in city centers, the consolidation of goods in the distribution center is important because in this way the entrance of large vehicles to city centers is prevented. This consolidation helps significantly in reducing the cost of freight transportation per unit, reducing the number of deliveries in one designated delivery sector and reducing delivery time. The goal of consolidation is to eliminate large trucks and the usage of smaller vans. This will result in big savings for transport companies, but as well for companies in urban centers which would benefit from fast and efficient service. The inhabitants of the city would be mostly satisfied because their quality of life would be improved by the reduction of pollution and noise. A precondition of efficient service is finding the location for a distribution center which should be located close to the city center.

4.2 Distribution of environmentally friendly vehicles

All major cities have problems with air pollution, a large amount of exhaust gases and CO₂ emissions, and thus offer a poorer quality of life due to the increasing concentration of motor vehicles in city centers. Some cities more often use small electric vehicles for the distribution of products to urban centers from dislocated warehouses that are located on the outskirts of the city. This mode of transport with certain disadvantages, such as loss of payload, a small number of electric filling stations and costly maintenance, has a number of advantages, such as reduction of CO₂ emission, lower noise pollution levels when in transit, swifter vehicle accessibility into the center of the city and on parts of the pedestrian zone and the like. In light of this, the distribution of goods from centralized urban distribution centers is inevitable in the future. The

greatest benefit in the whole process will have the residents of cities experience raised quality of life. Barcelona is an example of a city which invests exceptional effort in the sustainable development of urban centers through increasing the use of electric vehicles and bicycles. The reason for investing in electric vehicles is the sustainability of the city centers, reduction in air pollution, noise reduction and fuel savings. The urban infrastructure has adapted to this through the availability and greater number of charging stations. Such projects are supported by EU funds primarily through HORIZON 2020 projects.

5 Delivery in Rijeka's city center

City logistics refers to the means and way of successfully distributing cargo to city centers, by showing the efficiency of cargo transportation in city centers, with the goal to reduce traffic jams and minimize any negative environmental impact. The following text analyses the results of a survey about delivery locations in the city of Rijeka and the proposed location of a distribution center that would serve Rijeka's city center.

5.1 Analysis of delivery places in the city of Rijeka

At the end of 2014 a survey about the need of delivery in the Rijeka's center was carried out. The information was obtained from legal representatives in the city center itself, whereby 469 of the estimated 500 companies representing a sample of 93.8%, were interviewed. The data from the survey in Rijeka's city area shows that according to the National Classification of Activities most of them are wholesale and retail traders (50%), followed by shops that provide food services (15.81%).

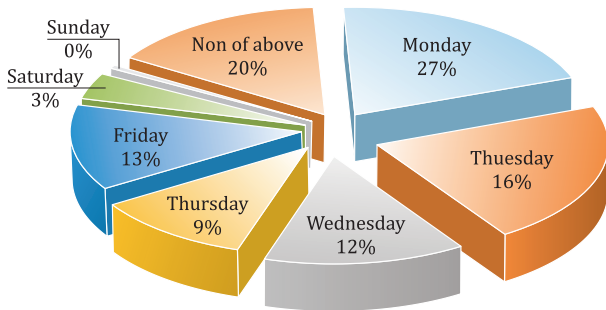


Figure 4 Delivery days

Source: Čišić D., Finale Report of survey, The needs of delivery in the center of the city of Rijeka, MED project, Smart green Innovative urban Logistics for Energy efficient Mediterranean cities, 2014.

Figure 4 shows that the largest number of deliveries are done on Monday (33.72%), followed by Tuesday (20.70%) and Friday (16.28%) with 24.88% of the companies recording no specific delivery time. As for the delivery of goods to companies in urban centers, 34.57% of them use their own means of transport, 45.30% of companies use the services of suppliers and 20.13% of enterprises use specialized transport companies.

Figure 5 shows that the largest number of deliveries take place in the morning 43% between 8 a.m. and 10 a.m., and 41% between 10 a.m. and 12 a.m. Just under a quarter of deliveries are between 12 a.m. and 2 p.m., 16% are between 6 p.m. and 8 p.m. and 11.4% are between 2 p.m. and 4 p.m., respectively. It is worthwhile pointing out that only 6% of deliveries are carried out during late afternoons and evenings. The problem is the deliveries at the so-called “rush hour”, when most people are going to and from work, often create additional traffic jams. [9]

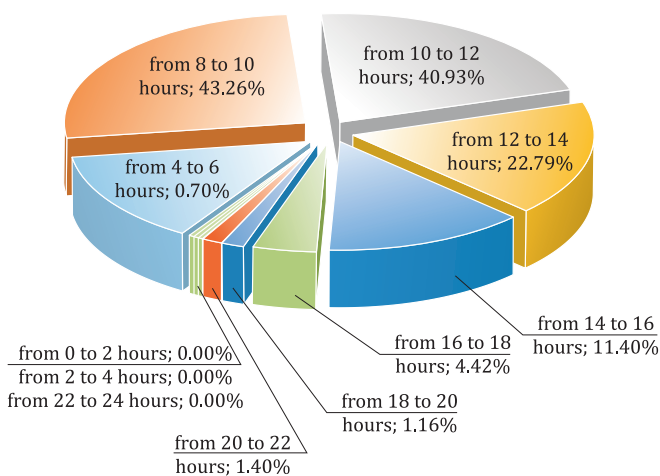


Figure 5 Delivery time

Source: Čišić D., Finale Report of survey, The needs of delivery in the center of the city of Rijeka, MED project, Smart green Innovative urban Logistics for Energy efficient Mediterranean cities, 2014.

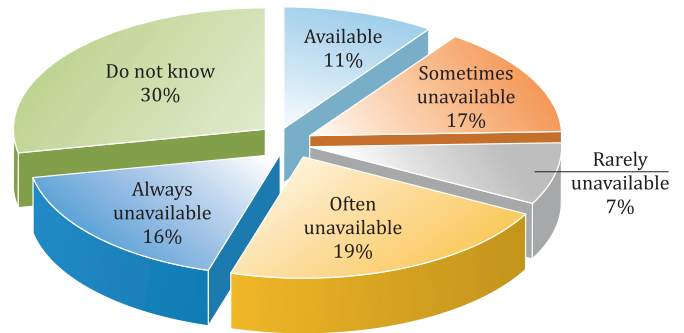


Figure 6 Regulated location

Source: Čišić D., Finale Report of survey, The needs of delivery in the center of the city of Rijeka, MED project, Smart green Innovative urban Logistics for Energy efficient Mediterranean cities, 2014.

Figure 6 shows that prescribed delivery locations are in 28% of the cases, often or very often, taken by other vehicles. Rijeka’s city center should increase the number of delivery locations, prohibit delivery during peak hours and create a system for monitoring and for the reservation of delivery locations.

5.2 Proposal of a Location for a distribution center for Rijeka’s city center

The supply of various goods in the center of Rijeka results in the arrival of a large number of different delivery vehicles. In spite of a significant number of specially designated parking places for delivery there is significant traffic congestion (especially at certain times of the day), due to improper stopping, a high concentration of vehicles circling in the city and, as a consequence, high CO₂ pollution. Most of these vehicles come to the city from wholesale distribution warehouses that are located outside the city, for example the industrial zone “Kukuljanovo” in the east, or warehouses located in Milutina Barača Street or directly from suppliers. The proposed location of a city distribution center would be in Krešimir Street near Rijeka’s bus station. At this location the goods that come from the “Kukuljanovo” industrial zone and other wholesale warehouses (and the potential future “Miklavlje” work zone), could be more readily collected and distributed to the city center.

The distance between the “Miklavije” future work zone and the proposed urban distribution center is 23 kilometers, while the distance to the industrial zone “Kukuljanovo” is 11.8 kilometers, according to <https://www.google.hr/maps>. In fact, the industrial zone “Kukuljanovo” is already extremely well connected by D-404 Road with the proposed distribution center, while the planned “Miklavlje” work zone will hopefully reach its peak with the construction of D-403 Road.

Figure 7 shows the distance between the proposed urban distribution center and the city center itself, which is 370 meters, according to <https://www.google.hr/maps>.

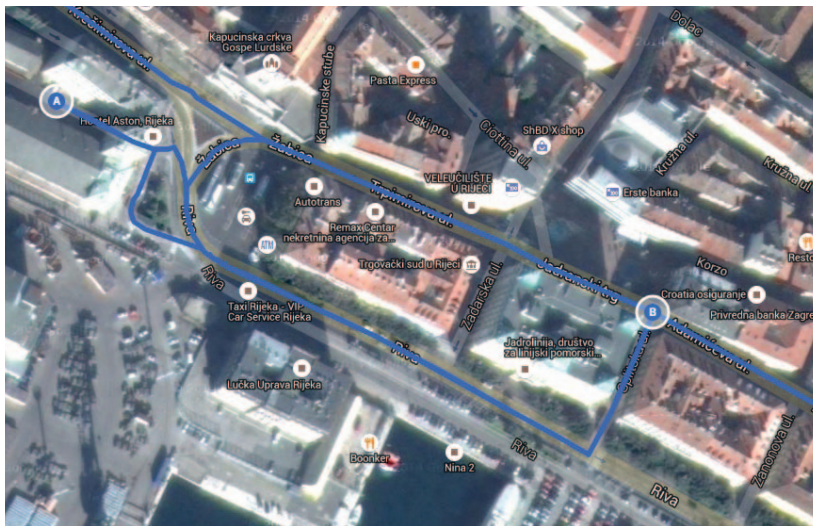
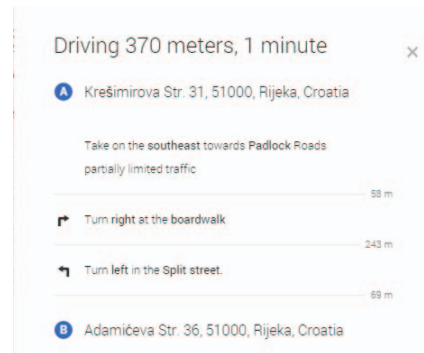


Figure 7 View of the route between the distribution center and the city center

Source: Made by author through googlemaps/mojekarte



This short distance creates numerous opportunities for the distribution of goods in the city center with environmentally friendly vehicles (primarily with small electric delivery vehicles, or electric bikes, which could enable access even to the pedestrian zone), and would certainly have a significant impact on the development of the city center by reducing traffic jams in the city, reducing greenhouse gas emissions and thus sustaining the development of the city center. Some utility companies in Rijeka recognized the advantages of such vehicles and are already using them in the city. The advantage of this location is not only justifiable from an environmental perspective but opens up numerous possibilities for better supply to and from companies in the city area, through more efficient services.

6 Conclusion

Transportation is the key and most important factor in the development of logistics management. Successfully organized logistics operations and their combined transportation measures enable the development of the entire supply chain, and thereby provide quality services to the end customer. The success of the supply chain depends primarily on the interconnection and coordination of all participants in the process of delivery. The assumption for this collaboration is the willingness to cooperate in order to find an optimal solution under diverse circumstances. Fast broadband internet, information technologies and assorted services that will be developed in the future on these platforms (smart phones, smart city, SUMPs-sustainable urban mobility plans), should affect future ways of doing business which will certainly open up many possibilities and will emphasize the need for interactivity among all participants of the supply chain. This mainly refers to the coordination of transport, with a focus on better organization and management of urban transport.

After the survey of the city center of Rijeka and detailed analysis, very concrete measures were proposed that can be implemented relatively quickly and without major financial resources. This implies the adoption of specific regulations of relevant city authorities (such as increasing number of delivery locations, the prohibition of delivery in peak hours and the establishment of a computer system for monitoring and reservation of delivery locations). A further positive role in the sustainable development of city centers should certainly play a distribution center outside the city center and the gradual introduction of electric and gas-powered delivery vehicles (accompanied by adequate network of electric charging stations) in the distribution of goods to end users.

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