



# **BUSINESS LOGISTICS** in Modern Management

Proceedings of The 14<sup>th</sup> International Scientific  
Conference

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Osijek, Croatia | 2014



JOSIP JURAJ STROSSMAYER UNIVERSITY OF OSIJEK  
FACULTY OF ECONOMICS IN OSIJEK

Proceedings of The 14<sup>th</sup> International Scientific Conference

**BUSINESS LOGISTICS IN MODERN  
MANAGEMENT**

October 16, 2014

Osijek, Croatia



*Published by*  
Faculty of Economics in Osijek

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UDK: 65.012.34  
ISSN: 1849-5931  
ISSN: 1849-6148 (Online)

Indexed in EconPapers

This publication is partly financed by Ministry of Science, Education and Sports of the Republic of Croatia.

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## Foreword

As the world economy is slowly recovering from years of crisis, business logistics continues to strengthen its position as the key rationalization and developing business function - both at the level of one economic entity and in the context of the entire supply chain who now know no boundaries. Continuing the respectable tradition, 14<sup>th</sup> International Scientific Conference Business Logistics in Modern Management once again explores the scientific and technical challenges within the different areas of logistics and supply chain management. Of particular importance is the fact that this year the Conference has highly emphasized international character due to scientific and professional contributions achieved through 17 papers and 33 authors from 10 countries (Germany, Austria, Poland, Turkey, Bulgaria, Slovenia, Serbia, Hungary, Bosnia and Hercegovina and Croatia). Certain papers in this publication are the continuation of the ERASMUS collaboration and other projects between scientists from the Faculty of Economics in Osijek and scientists from institutions of higher education in Pforzheim, Celje, Szeged, Poznan and Subotica.

In accordance with the growing importance of logistics in retailing, the largest number of papers is in the first thematic block with the same name. The section starts with a paper which is seeking for optimal strategy of stocking of retail outlets. It continues with discussion about space and technology developments and efficiency in retail trade, followed by paper on logistical challenges and potentials in multi-channel food retailing & distribution. Furthermore, authors discuss issues of retail ready packaging in food manufacturing industry, new scopes of retail internationalization, logistic distribution centers as business success factor, and modern developments in distributive trade.

Second thematic block is devoted to supply chain management from information and communication technology view and to supply chain security issue. Authors present interesting joint maturity model of business intelligence driven supply chain, followed by paper about changes of supply chain management in the information technology industry and its relation to sustainable development, and by paper that emphasize characteristics of supply chain management in the global electronic market. Here are also papers on influence of authorized economic operators on supply chain security, and on packaging quality assurance in supply chain.

Last section, called logistics in theory and practice, starts with a comparative literature analysis of definitions for logistics that aims to provide general definition of logistics, as well as definition of logistics subcategories. Next paper talks about firms' logistics capabilities for increasing international competitiveness. Besides, there are two case study papers concerning efficiency of cargo tram for city logistics compared to road freight transportation in Istanbul; and new distribution channels in historical city cores in the Adriatic region. We conclude whole publication with analysis of logistics education at Cracow University of Economics.

Finally, we would like to thank the Faculty of Economics in Osijekas the organizer, and to the Ministry of Science, Education and Sports, who have both supported the maintenance of this Conference. Likewise, we would like to offer a sincere thanks to international reviewing committee for their contribution in improving the scientific quality of this publication.

In Osijek, October 16, 2014.

Zdenko Segetlija, PhD  
Davor Dujak, PhD

# **I. LOGISTICS IN RETAILING**



## OPTIMAL STOCKING OF RETAIL OUTLETS: THE CASE OF WEEKLY DEMAND PATTERN

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*Scientific paper*

### *Abstract*

Retail stores sell products to consumers. Their ability to sell depends upon the availability of the planned assortment, i.e. every item is on shelf so that the consumer can buy it. In particular, for fast moving consumer goods, like food, the consumer expects that each item is on stock. The retailer's decisions on the length of replenishment cycles of stores, on the shelf-capacity allocated to each item, on the amount of inventory stored in the backroom of the store, on the minimum order quantity of each item, or on the case size affect the fill rate of the store.

This paper identifies a new aspect: With a demand fluctuating regularly according to a weekly pattern, the decision on which day to review inventory and to deliver stock has impact on the service level of the store. It analyzes the effect of the position of ordering cycles with respect to demand cycles on the out-of-stock rate. We simulate a retail scenario with different replenishment cycles, i.e. supermarkets with weekly seasonal demand can be supplied at different days of the week. We show -based on actual sales data of supermarkets- that the fill-rate depends heavily on the interaction between the weekly demand pattern and the inventory review and replenishment cycle. Furthermore, we demonstrate the role of item's case size in the performance of the supply chain. Numerical results for a periodic review, order-up-to-level inventory control system with batch-ordering and time-varying demand are presented.

**Keywords:** inventory management, retail operations, periodic review inventory control, seasonal demand, batch-ordering, case pack quantity

### 1. INTRODUCTION

Retailers serve consumers by providing a variety of products to them. Thereby they have to be able to sell any product at the demand of the consumer. Store-based retailers display their assortment in the store, i.e. grocers. In the foods segment the consumer expects to be able to buy at the moment he enters the store.<sup>1</sup> The desired

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<sup>1</sup>Many food products are sold as consumer packed goods. Due to frequent demand the consumer is accustomed to buy these products at arms length.

item should be available and ready to buy, i.e. on shelf. Therefore, the on-shelf availability (OSA) is a key performance indicator of any retailer.

Reports on OSA show different values depending time, product category, type of stock (permanent, seasonal, promotional (e.g. one week)), retail format (e.g. supermarket, discount), day of the week, time of day (i.e. bakery products). The OSA ranges from below 80% with ultra fresh products (i.e. bakery, fruits, poultry, meat) to 98% (canned foods). Although 98% sounds like a good performance, given the intense competition and low margins in the retail sector, any slight increase of OSA relative to competitors will have large effect on sales and profit.

What happens if the item is not available? The consumer may leave the store to shop another store; he selects another item for substitution; he postpones his purchase till next time in this store. In general, the occurrences of out-of-stocks reduce the retailer's and manufacturer's revenue. They are detrimental to consumer's loyalty and they deteriorate store's brand image.

Though we are not certain about a consumer's specific reaction to out-of-stock, it is clear that he does not like empty shelves. Consequently, retailers and manufacturers seek to increase OSA. Management of OSA is a supply chain problem as manufacturers and retailers contribute to OSA performance. Manufacturers improve OSA by timely delivery to retailers, by announcing new products timely, by providing case packs in the right size, etc. The retailer raises items' safety stocks to improve availability. However, this is not always feasible, as items compete with each other for scarce shelf-space.<sup>2</sup> Also, extra inventoring in the backroom is an option. Then, additional processes are required to identify the need to replenish shelves from backroom and to move items. Typically, a retailer has pre-determined the amount of shelf space allocated to each item and for each store.<sup>3</sup> Furthermore, the retailer sets the frequency of deliveries to the each store, e.g. a store will be supplied with dry foods every Monday and with fresh fruits and vegetables every day. The availability of the item depends on whether the order is large enough to protect the store from stockout between order arrival and arrival of the next order.

The objective of this paper is to determine the effect of the timing of inventory review in the presence of different daily demand that follows a characteristic pattern each week. The demand pattern repeats within the review cycle. For example the demand pattern repeats each week and replenishments are also scheduled once a week.

The remainder of this article is organized as follows. In section 2, a review of the literature is given. In section 3, we describe the model of the shelf replenishment process and the parameters of the simulation model. We present the results of the numerical simulation and draw conclusions from the results. Section 4 presents

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<sup>2</sup>Online retailing differs from store-based retailing as in the latter the items are assigned to specific areas of the shelf restricting the capacity for this item. The consumer learns the position of the item. The online retailer is more flexible to assign storage place for items as the consumer has no direct contact to the storage.

<sup>3</sup>These allocations are sketched in a planogram. It determines the location of the item on the shelf, the number of facings, and the allocated shelf space for this item (maximum number of units of the item).



major results and managerial insights. It concludes by a guide for future research ideas.

## **2. REVIEW OF THE LITERATURE**

The problem we address in this study refers to the area of inventory management. The literature on inventory theory is very extensive. Therefore, we restrict our review on publications directly addressing the inventory management problem at retail stores.

### **2.1. Contributions to the replenishment problem of the retailer and out-of-stock**

Corsten and Gruen (2005) provide an overview of the problem to increase on shelf availability. They report on their own empirical findings at retailers and review other studies between 1996 and 2003. The average out-of-stock rates (OOS rate) were found in those studies about 7 to 10 percent. The rates are different depending on the product category, e.g. fresh food categories (perishables) tend to have higher rates. However, the figures are subject to the measurement methods applied, also. Gruen and Corsten (2007) review different methods that define and measure OOS. Aastrup and Kotzab (2010) review two research streams dealing with OOS. The first is about consumer responses to OOS, the second is about the root causes of OOS: They propose to seek for the optimal level of OOS in terms of cost and gains instead of striving to a minimal OOS rate. Trautrimis et al. (2009) contribute to this gap. They explore the relation and trade-off between on-shelf availability and profitability of a retailer.

Van Donselaar et al. (2005) suggest a framework to divide the assortment of a retailer into five categories and to devise different inventory management procedures for each category. These categories are: products with short life cycle or short shelf life. They have to be inventoried carefully to due the risk of obsolescence. Promotion items realize increased sales due to marketing activities, one-time-items take advantage of special buying or selling opportunities (no replenishment), and capacity driven items that can be used to complement store operations at times of low sales rate and low frequency of consumers' arrival to smooth operations. For example, stores are replenished daily with fresh fruits and vegetables but only once a week with dry food at a day with low sales rate.

### **2.2. Contributions to instore logistics and inventory**

There are some papers dealing with the case size of items (number of units per retail shipping container) and two storage areas of items: shelf and backroom. The shelf is the preferred area as products are sold from shelf. The second place to locate inventory is in the backroom, where the consumer has no access. It serves to backup the shelf. However, the shelf replenishment process from the backroom is more costly as direct replenishment from arriving order. Furthermore, in real instances this process appears more unreliable since the backroom inventory is not tracked in

every supermarket. Raman, DeHoratius, and Ton (2001) report on diverse reasons why store level operations are unreliable and inventory records are inaccurate. With insufficient data on stocks automated ordering procedures are likely to fail.

Waller, Tangari, and Williams (2008) research on the question whether the case size has an impact on market share of the manufacturer. Their results indicate that the impact depends on the inventory turnover (demand). Items selling relatively slow compared to their case size and to their assigned shelf-capacity, will end up with lower market share for the supplier as the too large cases cause additional stock-outs at the retail level. These stock-outs are derived as being a consequence of an unreliable replenishment process between backroom and shelf.

Eroglu, Williams, and Waller (2013) also build upon the existence of a backroom as secondary storage. They extend the continuous review (s,q)-model to account for inventory in the backroom as well as on the shelf. In their model the case size determines the order quantity (q). If upon arrival of the order there is not enough shelf capacity available the excess inventory goes to the backroom. They derive a closed form solution for the total cost function as a function of reorder point (s) that includes the cost of carrying backroom inventory plus the cost for the replenishment of shelf from backroom inventory. The resulting model finds a lower reorder point at the optimum compared to a scenario not modeling the backroom storage. This is due to the additional cost of the backroom inventory that increases with case size since with larger case size it is more likely that part of the order goes through backroom storage at higher cost. The model does not account for lost sales but instead models backorders.

Simulation is a very powerful tool to analyze complex business processes under uncertainty. Routroy and Bhausaheb (2010) model inventory control by a discrete event simulation with ARENA software tool. It incorporates periodic review inventory control and tracking shelf life of items that are subject to obsolescence.

Items or cases tagged with RFID technology can be used to track inventory movements in store. Condea, Thiesse, and Fleisch (2011) develop a heuristic periodic review inventory control procedure that accounts for failures of RFID equipment in detecting each movement of cases between backroom storage and sales floor. They present results of a simulation.

Kotzab, Reiner, and Teller (2007) describe their findings from an analysis of processes in stores. They identify a generic in-store process and conduct a survey on the parameters of the in-store processes of 113 stores like distances between backroom storage areas and shelves. Then these parameters were used to simulate the sales process and inventory replenishment process.

### **2.3. Contributions to perishability of inventory**

Perishable items, i.e. products with relatively short shelf lives, have found extended attention in recent years. For example, yogurt is suggested to be consumed within 30 days after production whereas canned food has a best before period (sometimes called shelf life) of about 12 months or more. Perishability of items imposes more restrictions on handling, as the potential of loss is higher. If the products are overstocked, the retailer might not sell them within the shelf life and

they have to be discarded. The review of Goyal and Giri (2001) classifies deteriorating inventory models according to the items lifetime, e.g. fixed (short) lifetime or random lifetime (e.g. for fresh fruits like strawberries), and the type of demand, e.g. stock-dependent, price-dependent or stochastic demand.

The book of Nahmias (2011) brings together a concise review of models for managing inventory of perishables. Van Donselaar et al. (2006) classifies items in grocery retail and discusses inventory control rules for perishables that are applied in practice. For example, items with shelf lives below 1 to 5 days need short lead times to reduce uncertainty within the protection period and restricted assortments to keep up daily sales. The automated store ordering system (ASO) observed in their study applies periodic review inventory control with reorder level and reorder size as a multiple of case size. In order to cope with varying demand, the reorder level is adjusted by a forecast for the period of leadtime plus review (protection period).

With perishable items it is necessary to monitor the age of items in inventory. Broekmeulen and van Donselaar (2009) suggest a model tracking the age of inventoried items. They conduct a discrete event simulation for a single product single store scenario. The model has daily review of inventory after closing the store, removing out of date inventory and ordering for the next day. Facing different ages of items on display the consumer selects the item with preferred age. The simulation applies LIFO and FIFO item selection from inventory to model the consumer's decision on which product to buy from a stock of items with different remaining shelf lives.

## **2.4. Contributions to multi-stage inventories and supply chain design**

Kanchanasuntorn and Techanitisawad (2006) simulate a two-echelon distribution system with perishable items under periodic review policy. On the first stage, at the central warehouse, items are backordered, whereas on the second stage, the retail level, unsatisfied demand is lost.

Cardós and García-Sabater (2006) model the design of the retailers supply system, i.e. from central warehouse to stores, that comprises vehicle routing decisions, delivery frequency and inventory management (here periodic review order up to level). Also Sternbeck and Kuhn (2014) describe an application that determines store delivery patterns based on an analysis of central warehouse operations, transportation to stores, and instore handling for a grocery retail chain. Agrawal and Smith (2013) point on the problem that demand of items is different from store to store. In their 2-period-model a given stock of items has to be allocated to stores. Since demand is correlated they propose an updating procedure for demand forecasts to improve inventory allocation to individual stores in the second period.

Lütke Entrup (2005) researches on the consequences of restricted shelf life of items on the production at the manufacturer. It suggests extensions of manufacturer's advanced planning system for some food industries with perishables, e.g. yogurt or sausages.

Another research direction with short lived products focuses on information sharing between retailer and supplier to increase the remaining shelf life of inventoried items at the point of sale. Ferguson and Ketzenberg (2006) simulate a periodic

review inventory control rule with short shelf life and information sharing of items expiry date from the supplier to the retailer before ordering with a periodic review inventory control scheme. The value of this information is estimated as change in net profit given that inventory of outdated products must be discarded. The proposed methodology is tested in a simulation. Eksoza, Mansouri, and Bourlakis (2014) review the literature on collaborative forecasting and information sharing in the food supply chain.

Chen, Geunes, and Mishra (2012) research on a specific type of case pack, the distribution case pack. Contrary to a regular case pack that contains more than one unit of a given product, a distribution case pack contains a variety of different items. A store that stocks a distribution case pack will be able to offer a variety of products in a single shelf space thereby reducing handling requirements in the store as well as in the upstream supply chain. The article models the trade-off between reduced order handling costs and higher inventory-related costs under dynamic, deterministic demand using dynamic programming.

Bischak et al. (2014) derive an expected cost function and approximate optimal solution of a periodic review inventory model with potential crossover in replenishment deliveries. Puts (2013) researches the inventory control rules at a Dutch food retailer with focus on items with low sales rate. The thesis provides detailed operational details and insights.

### **3. ANALYSIS OF A RETAILER'S LIMITED SHELF CAPACITY BATCH ORDERING POLICY**

Today's grocery retail market is dominated by large retailers operating chain stores. They operate hundreds or even thousands of stores under one or sometimes two or more banners, i.e. retail formats like supermarkets or hypermarkets. Thereby they can achieve economies of scale in their operations. Stores appear similar, have similar assortments and are operated by the same processes. For example, they operate central warehouses where products from manufacturers are consolidated, stored and then picked to replenish the stock at the outlets. There the goods are presented on shelves and other display furniture to be sold to the consumer.

#### **3.1. General setting and assumptions of the model**

We model the inventory level on shelf at a single store. We restrict our model to a single SKU (stock-keeping unit), as we assume that the selling and restocking process is independent of other items. Then the sales of other items in the assortment do not affect the item under study.

We assume that items shipped to the store will be immediately available on shelf. The inventory review, the delivery process, and the in-store handling process are deterministic and without failure. Any stock ordered will be ready on shelf in the planned period.

The inventory is replenished based on an order-up-to-level, periodic review inventory control. However, only case packs can be ordered, i.e. the either one, two,

three, etc. case packs of the item can be ordered given that the order size will fit into shelf. The batch size of orders is the case size or multiples of it.

For example, under a case size of 6 and a maximum assigned shelf space of 8 units: If there are 2 units of product on shelf of the item, the ASO will order 1 case of 6 units. If there are 3 units of product on shelf no case will be ordered.

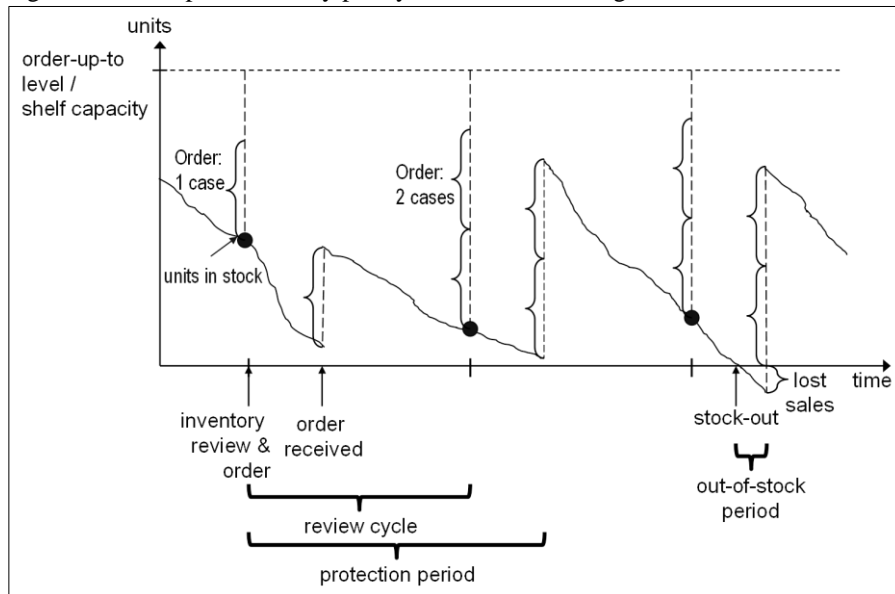
Our survey among different German retailers (Edeka, Rewe, Aldi, Globus) in Germany showed that the orders for the category of dry food have a lead time of one day. The inventory on shelf is reviewed in the evening on day 1, the orders are transmitted to the central warehouse and delivered on day 3 before opening the store. E.g. an order that is placed on Tuesday will be delivered and ready for sale on Thursday, an order placed on Friday will be delivered by Monday. The stores are closed on Sundays, also there are no deliveries to stores on Sundays. An example of opening hours of grocers in Germany is: Monday through Saturday from 8 a.m. to 10 p.m.

For ease of presentation, we assume that the inventory level on shelf is known at the time of closing of the store on day 1 so that the order can be placed. Also, the replenished stock is available immediately from opening at day 3. So, the lead time is 1 day. This is also the span of time during which the remaining stock on shelf should be sufficient to cover demand. However, the total protection period of the stock is between two consecutive reviews plus the lead time. For example, if the store is delivered once a week, the protection period of the stock is 7 selling days. So, if we review on shelf-inventory on Monday and do not place an order (for Wednesday) the stock has to be enough to fulfill the demands till Wednesday the following week. Otherwise there will be unsatisfied demands (lost sales). Figure 1 depicts the order-up to inventory policy with batch-ordering. Obviously, the units on hand will not reach the maximum inventory level unless the difference between order-up-to-level and the inventory level at the time of review is an integer multiple of the case size and there are no sales in the order lead time, i.e. till the receiving and restocking shelf.

When the consumer arrives and the desired item is not on shelf, his demand cannot be satisfied. We account for this situation as lost sales. As we track only one item in our model we do not consider any substitute sales (the consumer selects another product).

When calculating the order quantity, the order quantity is based on shelf space only and not augmented by a demand forecast. We want to be sure that the ordered quantity will fit into the shelf. If we increase the order to account for units that are likely to be sold during lead time, we may end up with overflow inventory if demand is lower than forecasted. Items in excess of shelf space could be stored at a different place like the backroom but at the cost of a more complex refill process.

Figure 1 Order-up to inventory policy with batch-ordering



Source: Author

Consumers can shop the stores six days a week. But they do not buy in the same intensity every day. The number of customers and their shopping baskets vary over the week. The daily sales of a store are not constant. Each store shows a more or less regular pattern of sales during the week. In many instances Fridays and Saturdays are the strongest selling days during the week. Also the monthly sales are seasonal, as the first days of the month are usually stronger. The yearly sales pattern, for example is that there is seasonality with peaks around Christmas season, after summer holidays and the Easter Season. However, for the weekly stocking decision monthly and yearly patterns are less important.<sup>4</sup> Therefore, we model a weekly demand pattern only.

### 3.2. Model settings and numerical results

We consider a single SKU with an average demand of 1 unit per day and a standard deviation of 0,67 units. Daily demand is assumed to follow an independently identical Normal distribution (before adjusting for the weekly demand pattern).<sup>5</sup> The lead time is 2 days, so that between review and availability of new stock is one selling day. We have six selling days per week. The weekly demand is assumed to have an increasing daily demand from Monday through

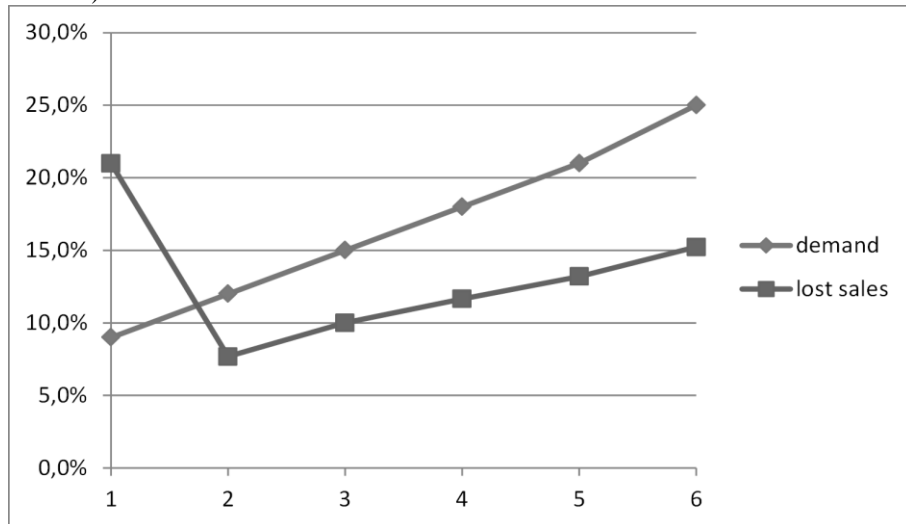
<sup>4</sup>In case of high demand before holidays the parameters of the inventory policy can be adjusted to increase the inventory on shelf. For example, if the order-up-to level is below shelf capacity for that item, it can be increased before beginning of the high sales period. Else, retailers implement shorter reorder cycles during that time.

<sup>5</sup>The random variable is truncated at zero.

Saturday. The total weekly demand is distributed as 9% of weekly demand on Monday, 12% on Tuesday, 15% on Wednesday, 18% on Thursday, 21% on Friday, 25% on Saturday. The case size is 6 units and the allocated shelf space is 8 units, i.e. a reorder will be scheduled on the review day, if the actual stock is between 0 and 2 units.

Figure 2 exhibits the demand pattern. Demand is increasing from Monday (1 on x-axis), Tuesday (2) to Saturday (6). This demand pattern is repeated week by week. Figure 1 also shows the result of the simulation run in terms of lost sales. It provides a comparison of lost sales ratios. The lost sales ratio is associated with the delivery day of the week. It starts for Monday with a high rate of 21.0%. The lost sales are 21.0% if the store is delivered on Monday. The quantity delivered on Monday is based on the Friday closing stock on shelf. If under the same data the inventory review would have been on Saturday and delivery on Tuesday the lost sales would drop to 7.7% for the whole simulated time.

Figure 2 Demand pattern and lost sales by delivery day with batch-ordering (case size = 6)



Source: Own simulation

Table 1 shows how the lost sales ratio is composed of by day. It gives the sample lost sales for each day of the week. For example, if the delivery of order is on Monday (left column), there were no lost sales on Mondays, 0.2% lost sales occurred on Tuesdays, 3.3% on Wednesdays, 5.2% on Fridays, 10.7% on Saturdays. In total there are 21.0% of lost sales. Note, that the lost sales ratios increase day-by-day in this example. But this must not be the case, as we account for lost sales only upon arrival of demand. If there is no demand on a specific day, it does not contribute to lost sales figure – though the shelf is empty till delivery. This is different to the concept of calculating a shelf-availability ratio that would account for the time the shelf is empty. This figure would rise in the same situation.

Table 1 Lost sales by day of delivery

	lost sales if delivered on					
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Monday	0,0%	1,0%	0,7%	0,4%	0,3%	0,3%
Tuesday	0,2%	0,0%	3,7%	1,9%	1,5%	1,3%
Wednesday	1,5%	0,0%	0,0%	4,8%	2,6%	2,3%
Thursday	3,3%	0,2%	0,1%	0,0%	6,1%	3,1%
Friday	5,2%	1,6%	1,7%	0,9%	0,1%	7,5%
Saturday	10,7%	4,9%	3,9%	3,5%	2,7%	0,8%
sum (week)	21,0%	7,7%	10,0%	11,7%	13,2%	15,2%

Source: Own simulation

In this example, the lowest lost sales result from deliveries and restocking on Tuesdays, the highest lost sales is due to deliveries on Mondays. Regarding the demand pattern, the best results stem from replenishments on Tuesday followed by inventory reviews on Saturday. Since Saturday is the strongest selling day in our example, here it pays to see the demand on Saturday before decision to order. On Monday, demand drops to low level and rises again until Saturday. In more experiments, we have noticed that the drop of demand appears to be the driving factor for the lost sales ratio. For example, if sales on Saturday are slightly lower than on Friday and the big drop is to Monday, Saturday remains the optimal inventory review time.

### 3.3. Discussion of the simulation results

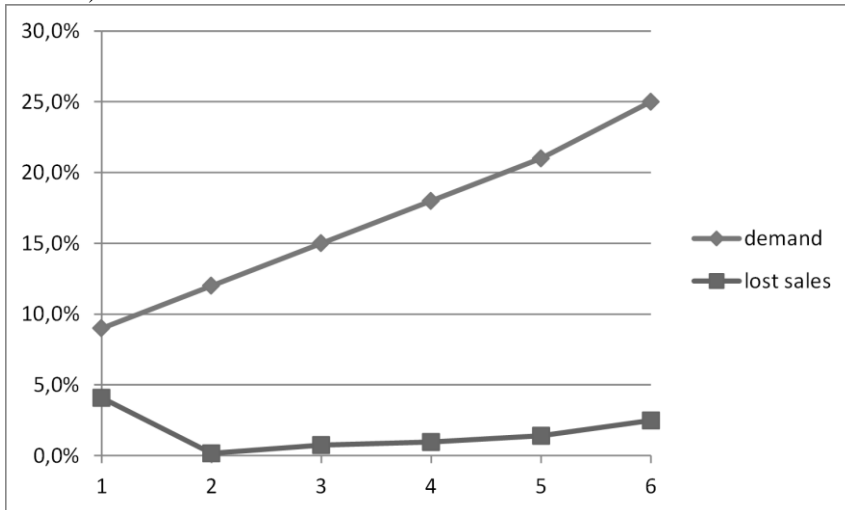
Hence, under time-varying demand with constant delivery cycles the occurrences of lost sales depend on the timing of order review and deliveries with respect to the weekly repeating demand profile, i.e. demand peaks and lows during the week. We could show that the demand profile is a relevant parameter that affects the performance of the store's inventory policy. For example, it appears, that the inventory review should preferably carried out immediately after peak demand.

This result does not depend on case size. Figure 3 shows that with no restrictions on minimum order size (case size of 1), the lost sales ratios still depend on the demand pattern. Given the aforementioned demand pattern of this example, reviewing inventory at the demand peak on Saturday and delivery on Tuesday generates the highest fill rate.

The possibility to reorder only in cases carrying a fixed amount of items imposes further restrictions on efficient use of shelf space. However, the usage of cases simplifies handling in the supply chain. In the decision on case size, the effects on sales should be incorporated. Though manufacturers have factored in the effect of case size on shelf space assigned and the number of facings in the planogram, i.e. they hope that retailers assign larger shelf space to the item if there is a larger case, they may have not factored in the detrimental effect of case pack quantity on fill-rates of shelves.



Figure 3 Demand pattern and lost sales by delivery day with batch-ordering (case size = 1)



Source: Own simulation

We have assumed that demand is not forecasted at the moment of inventory review. This is no restriction on results, as the forecast would only serve to order less than the maximal integer multiple of cases such that the order fits into shelf space. As forecasts are not certain by nature we cannot be sure if we order more than actual shelf space that the order will fit into assigned shelf space. So, forecasts to increase the amount of inventory in store during the protection period would have to rely on additional storage, like a backroom storage.

## 4. CONCLUSION

On-shelf availability remains a management issue for each retailer. The fill-rates of stores still did not reach 99.9 percent, though the fast moving consumer goods industry has spent considerable effort on it. Out-of stock reduction is likely to be a management issue in the future. Increasing assortments of retailers contribute to this phenomenon. An increase in the number of stock-keeping units in a store will increase the uncertainty of demand. Then, to keep the same service level, the number of stored units per item has to be increased. Also the complexity of logistics systems increase. In the end, the decision on fill rate is an economic decision. Therefore, the need to improve the procedures in the retailer's supply chain will rest on the agenda.

### 4.1. Managerial implications

We showed that a simple alignment of the timing of stores inventory review and replenishment to the demand pattern of each store decreases the out-of-stock

ratio considerably. Differences in daily demand during the replenishment cycle— no matter if we can forecast demand correctly or not- ask for selecting carefully the day of inventory review and replenishment. This result is very interesting as it holds independently on the reaction of consumer on stock-outs. Whether it is lost sales in an out-of-stock situation or the consumer selects a substitute is irrelevant. The retailer will be better off if he can improve the on-shelf availability with simple actions, like aligning the review and delivery schedules of the stores. This result is of high practical value as the impact on sales and consumer satisfaction can be dramatic.

Many chain retailers supply hundreds of supermarkets from one central warehouse. It should be easy to analyze weekly demand pattern of each store and to propose the store's optimal inventory review and replenishment schedule. This can be done regarding total sales pattern of the store or by category sales that are consolidated within one delivery. We expect that the optimal schedule will not be the same for all stores. For example, stores in the reach of residential areas may have peak demands on Friday or Saturday, stores located in proximity to business districts have higher demands during the week.

The decision to adjust the delivery schedules for the retailer is simple to implement, as it does not rely on decisions at other companies like changing the case size would. Of course, not all products will have the same demand pattern during the week. In an actual case, the set of products to be included into a single delivery would have to be evaluated by product.

Other options to increase availability like lowering the case pack size will have impacts at many steps in the supply chain: The manufacturer has to change packing including new machinery, the picking at the retailers warehouse becomes more costly as more cases have to be picked, the handling in store is more labor intensive since opening two 6-unit cases and putting to shelf is less time consuming than handling of three 4-unit cases. So, there would be high (inter)organizational barriers to implement different case sizes. For private label products it is an interesting consideration as the retailer decides himself on case pack quantity.

## 4.2. Further Research

The review of the literature showed that quite complex models have been developed to improve the OOS situation. However, our approach is quite simple. Therefore, the idea of this paper might be integrated in more complex models already described in the literature.

Our demand pattern was very simple for exploratory reasons. Using simulation it is straightforward to analyze specific patterns. Another research direction is to derive general results from a closed stochastic model that extends the literature by including a demand pattern.

As our model did not incorporate a reorder point this might provide further insights as we can control the number of replenishments by varying the reorder point. In some applications this option helps to control the number of stock-keeping units per delivery. This will have an effect on the cost of the instore shelf filling process. Also order picking and delivery schedules can be designed in face of scarce

capacity, e.g. for larger stores two deliveries with disjunct assortments can be scheduled.

As the decisions to optimize OOS is at the cutting point of logistics and marketing, the effects of OOS on lost sales or substitution could be integrated into the model. For example, stock-outs at high selling days with large frequency will have more impact on customer perception than on quiet days. The shopper who is not to buy a specific out-of-stock item will still take notice of empty shelves with negative effect on his store's brand image.

## 5. REFERENCES AND SOURCES OF INFORMATION

1. Aastrup, J. & Kotzab, H. (2010). Forty years of Out-of-Stock research : and shelves are still empty. *International Review of Retail, Distribution & Consumer Research*. 20 (1), pp. 147-164.
2. Agrawal, N. & Smith, S.A. (2013). Optimal inventory management for a retail chain with diverse store demands. *European Journal of Operational Research*, 225 (3), pp. 393–403.
3. Bischak, D.P., Robb, D.J., Silver, E.A., Blackburn, J.D. (2014). Analysis and Management of Periodic Review, Order-Up-To Level Inventory Systems with Order Crossover. *Production and Operations Management*, 23, (5), pp. 762–772.
4. Broekmeulen, R.A.C.M. & van Donselaar, K.H. (2009). A heuristic to manage perishable inventory with batch ordering, positive lead-times, and time-varying demand. *Computers & Operations Research*, 36 (11), pp. 3013–3018.
5. Corsten, D. & Gruen, T. (2005), *On Shelf Availability: An Examination of the Extent, the Causes, and the Efforts to Address Retail Out-of-Stocks*. In Doukidis, Georgios J. and Vrechopoulos, Adam P., (ed.). *Consumer Driven Electronic Transformation: Applying New Technologies to Enthuse Consumers and Transform the Supply Chain*. Springer, Heidelberg, pp. 131–149.
6. Cardós, M. & García-Sabater, J.P. (2006). Designing a consumer products retail chain inventory replenishment policy with the consideration of transportation costs. *International Journal of Production Economics*, 104 (2), pp. 525–535
7. Chen, S., Geunes, J. & Mishra, A. (2012). Algorithms for multi-item procurement planning with case packs. *IIE Transactions*, 44 (3), pp. 181-198.
8. Condea, C., Thiesse, F., Fleisch, E. (2011). *RFID-Enabled Shelf Replenishment with Backroom Monitoring in Retail Stores*. Auto-ID Labs White Paper WP-BIZAPP-063, November 2011
9. van Donselaar, K., van Woensel, T., Broekmeulen, R., Fransoo, J. (2005). *Improvement Opportunities in Retail Logistics*. In Doukidis, Georgios J. and Vrechopoulos, Adam P., (ed.). *Consumer Driven Electronic Transformation: Applying New Technologies to Enthuse Consumers and Transform the Supply Chain*. Springer, Heidelberg, pp. 9–23.
10. van Donselaar, K., van Woensel, T., Broekmeulen, R., Fransoo, J. (2006). Inventory control of perishables in supermarkets. *International Journal of Production Economics*, 104 (2), pp. 462–472.

11. Eksoza, C., Mansouria, S. A., Bourlakisb, M. (2014). *Collaborative forecasting in the food supply chain: A conceptual framework*. *International Journal of Production Economics*, 158, pp. 120–135.
12. Eroglu, C., Williams, B.D., Waller, M.A. (2013). The Backroom Effect in Retail Operations. *Production & Operations Management*, 22 (4), pp. 915-923.
13. Ferguson, M. & Ketzenberg, M.E. (2006). Information Sharing to Improve Retail Product Freshness of Perishables. *Production & Operations Management*, 15 (1), pp. 57–73.
14. Goyal, S. K. & Giri, B. C. (2001), Recent trends in modeling of deteriorating inventory, *European Journal of Operational Research*, 134 (1), pp. 1–16.
15. Kanchanasuntorn, K. & Techanitisawad, A. (2006). An approximate periodic model for fixed-life perishable products in a two-echelon inventory–distribution system. *International Journal of Production Economics*, 100 (1), pp. 101–115.
16. Kotzab, H., Reiner, G., Teller, C. (2007). Beschreibung, Analyse und Bewertung von Instore-Logistikprozessen. *Zeitschrift für Betriebswirtschaft*, 77 (11), pp. 1135–1158.
17. Lütke Entrup, M. (2005). *Advanced Planning in Fresh Food Industries: Integrating Shelf Life into Production Planning*. Contributions to Management Science, Springer, Heidelberg.
18. Nahmias, S. (2011). *Perishable Inventory Systems*. In: International Series in Operations Research & Management Science, Volume 160, Springer, Heidelberg.
19. Puts, L.C.G.A. (2013). *Slow moving items in grocery supply chains at Sligro Food Group*. Master Thesis, Technische Universiteit Eindhoven.
20. Raman, A., DeHoratius, N., Ton, Z. (2001). Execution: The Missing Link in Retail Operations. *California Management Review*, 43 (3), pp. 136-152.
21. Sternbeck, M.G. & Kuhn, H. (2014). An integrative approach to determine store delivery patterns in grocery retailing, *Transportation Research Part E: Logistics and Transportation Review*, 70 (October 2014), pp. 205–224
22. Routroy, S. & Bhausaheb, N.A. (2010). Evaluation of Inventory Performance for Perishable Products Through Simulation. *IUP Journal of Operations Management*, 9 (1/2), pp. 71–80.
23. Trautrim, A., Grant, D.B., Fernie, J., Harrison, T. (2009). Optimizing On-Shelf Availability for Customer Service and Profit. *Journal of Business Logistics*, 30 (2), pp. 231–247.
24. Waller, M.A., Tangari, A.H., Williams, B.D. (2008). Case pack quantity's effect on retail market share: An examination of the backroom logistics effect and the store-level fill rate effect. *International Journal of Physical Distribution & Logistics Management*, 38 (6), pp. 436–451.

## **SPACE AND TECHNOLOGY – DEVELOPMENT AND EFFICIENCY OF RETAIL TRADE**

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*Scientific paper*

### ***Abstract***

The paper sets out from the business space (selling space, shop warehouse space etc.) and technology in the retail trade as factors of development of the retail trade in a particular country. As important factors of retail trade effects, space and technology can be analysed from marketing and from logistic points of view (in the sense of implementation of modern business conceptions). The importance of space and technology is also observed in the analysis of principal development directions in the formation of retail operating units.

On the basis of the chosen indicators and accessible statistics for selected European countries (and in particular for the Republic of Croatia), the author analyses the development of retail trades in respect to the reached relative size of selling space and the used technology. Additionally, for selected countries, there is also an analysis of the efficiency of retail trade in relation to the used selling surfaces. Based on the performed analysis, it can be concluded that, in addition to the relative size of the selling space, indicators relating to the use of modern technologies and logistical solutions should also be used as indicators of development of retail trade. This would allow for a better explanation of insufficient efficiency of retail trade for the total economic development of the observed countries.

**Key words:** retail trade, selling surface, business logistics, retail supply chain, Republic of Croatia

### **1. INTRODUCTION**

Based on accessible literature, the paper first brings an analysis of the retail trade and its importance, and then continues with the analysis of space and technology as elements of the business process in the retail trade from the points of view of marketing and logistics. This is followed by basic remarks about the main development tendencies in the formation of retail operating units and retail companies from the point of view of their size (selling surface) and from the point of view of the implementation of modern technologies and business conceptions. The

analysis of indicators of development and of the effects of retail trade, on the basis of accessible statistics, is performed for the Republic of Croatia and for selected European countries: Austria, Finland, Italy, the Netherlands, Germany, Norway, Czech Republic, Hungary, Poland and Slovakia. Indicators are presented in tables and graphically.

The purpose of this paper is to indicate the importance of selling space and technology in the functioning of international retail chains, i.e. of retail supply chains, which also affects the efficiency of retail trade.

## **2. RETAIL TRADE, SELLING SPACE AND TECHNOLOGY**

The object of research in this paper is the development of retail trade from the points of view of space and technology. Therefore the first step is the definition and analysis of the concepts “retail trade”, “retail chain” and “retail supply chain”, followed by the definition of the concepts “space” and “technology” as elements of business processes, in order to arrive at selected development and efficiency indicators of the retail trade that are connected with space and technology.

### **2.1. Retail Trade in the Supply Chain**

Retail trade includes all transactions in which buyer intends to consume the product through personal, family and domestic use (Dibb, Simkin, Pride, Ferrel, 1995, p. 334). Therefore, it concerns sales of goods or services to a household personally or the activation of this household in the retail trade (Mason & Mayer, 1990, p. 5).

Everything stated above leads to the conclusion that the concepts “retail trade” and “retail” can be used as synonyms. In this paper the term “retail” will be used in the meaning of selling merchandise (and services connected with these goods) to the final buyer, the consumer, regardless of which business entity performs this activity.

It is therefore important to emphasize that retail is the selling of goods and services to the final consumer (Cox & Brittain, 1990, p. 3). However, in modern conditions of trade marketing it is often said that retail consists of marketing activities formed with the purpose of achieving satisfaction of the final consumers and profitable retaining of these consumers on the basis of a program of continuous improvement of quality (Hasty & Reardon, 1997, p. 10).

In that sense, today we can say that the retail trade comprises a number of activities that add value to the product and service sold to consumers for their personal or family use (Levy & Weitz, 2007, p. 21).

The object in our analysis are retail companies (or retail groups) which can also deal in wholesale trade. The retail chain is a company doing business with many retail units under collective ownership and it usually has centralized decision-making regarding the definition and implementation of its strategy. Some retail chains are divisions of larger corporations or holding companies (Levy & Weitz, 2007, p. 62).

In many research works it has already been emphasized that retail chains are important because of their size, because of the possibility of further expansion and because of the introduction of new technologies. Advantages of international retail chains lie in the fact that they have concentrated their functions, so that they are much larger than the national retail chains in the countries in which they are doing business. The largest European retail chains operate in a number of countries (both in Europe and on other continents). So, for example, Carrefour is present in 36 countries, the Metro Group in 33 countries, Tesco in 13 countries, Schwarz-Gruppe in 25 countries, Rewe Group in 13 countries, Auchan in 14 countries, Leclerc in 6 countries (xxx 2011, 2010 The 250 Global Retailers).

Retail trade is an integral part of the so-called value creation chain. Namely, every product or service has its value creation chain. Depending on the assortment it is doing business with, a retail company is the integrator of different value chains.

In that sense creation of value is the result of a target oriented chain of activities within and outside of the company which – depending on the angle of observation – are marked as: business process, value creation process, or as the logistic chain, chain of supply, i.e. supply chain (Berning, 2002, p. 7), or else as “logistic network” (Mandel, 2011, p. 15).

Today it is pointed out that managing the supply chain means “complete integrated planning and management of processes in the entire value chain with the aim to optimize the satisfying of buyers’ needs” and that “managing the supply chain includes complete tasks of logistic coordination in the logistic network” (Kämpf, Növig, Yesilhark, 2008, p. 2).

In present-day supply chains, for example in the grocery sector, retail chains are most powerful, and manufacturers depend upon them (Dujak, 2012, pp. 41– 44). When a large retailer (retail chain) dominates in the supply chain, the expression “retail supply chain” can be used.

For a particular country, retail supply chains are also important from the foreign exchange standpoint, because the entry of a large international retail chain automatically means the entry of the entire supply chain, regardless of which manufacturers of goods and providers of services (from which countries) will become members of such canals. Namely, in the present-day conditions processes of internationalization and globalization of business operations are developing.

Retail trade takes place in operating units – shops, but there is also the out-of-shop retail trade (for example online retail trade). The retail operating unit is, therefore, important not only from the point of view of the contact with final buyers, but also from the point of view of its linking into supply chains.

One of the operating unit forms could also be the image of a retail operating unit as shown by applied variables of market strategy (Müller–Hagedorn, 2005, p. 81), i.e. by the marketing strategies of the retail company.

The formats of operating units are products of the retail company’s strategy and they support the picture that the buyers have of a retail company; and the planned formation of a strategy of the formats of operating units is an important prerequisite for the success of that company (Ahlert&Kenning, 2007, p. 111). Of course, retail companies develop particular formats of their operating units in order to achieve competitive advantage.

## 2.2. Space and Technology as Factors of Retail Effects

The realization of retail effects (sale of goods and services) requires the running of certain working processes, of certain activities. The running of working processes in the trade requires elements that can generally be listed as follows (Segetlija, 2006, p. 125): (a) human resources (personnel), (b) property (assets), and (c) organization. Business space is a specially important factor in retail trade.

The main forms of space in a retail company are (cf. Lerchenmüller, 2003, p. 219):

- selling space
- showroom
- warehouse space
- manipulation area
- space for administration
- space for social activities
- traffic area
- car parks
- other auxiliary surfaces.

The use of space demands investment into its construction and the necessary infrastructure, as well as investment into its incorporation into wider complexes. This also generates other expenses such as rent, amortization and the like. Of course, the usage of space brings about additional costs (heating, cooling, illumination, water, cleaning, and maintenance). While in towns the prices of the ground and fees for its utilization are constantly growing, outside of towns these prices are considerably lower (but it is necessary to invest in the infrastructure).

The possibilities for cost saving when space is in question include better design of buildings and appliances, better utilization of space, as well as better rent contracting, setting up of more efficient and economical devices and appliances, choice of more favourable energy tariffs, etc.

The quality of space in a retail operating unit depends both on its location as an instrument of marketing (e.g. accessibility of the selling space or its division and decoration within the shop), and on the work performed in that space (e.g. displaying goods, manipulating goods, arranging goods on shelves and the like). Therefore, space plays a double role: a role in the sense of marketing and another role in the sense of logistics.

In the retail trade, however, it is not the selling space but the selling surface that is measured. The official statistic defines the selling surface as follows (Sales Capacities in Retail Trade in 2009):

„Sales space is a floor area (expressed in  $m^2$ ) of a facility in which the sales of goods takes place, including an in-door exhibition area (shop window), that is:

- the total area onto which customers are allowed to enter, including change rooms,
- cash desk counter and window area,
- area behind a cash desk to be used by cashiers.



The sales area does not include offices, warehouses and preparation rooms, workshops, staircases, toilets and other auxiliary rooms. In cases that sales takes place on several floors, the sales area is expressed as a sum of areas of all floors”.

Specific business processes take place in a specific space following specific technology (in the retail trade these are sales-purchase and other business processes). It can be generally said that the tasks of a company are realized by means of different technologies (cf. Sikavica & Novak, 1999, p. 78). There is therefore a connection between technology and organization. However, technology may also be observed as an exogenous strategy factor of a company, as an uncontrolled variable.

Since the chosen technology affects the organization of business processes in the retail operating unit, size and format of the selling surface must be in conformity with the chosen technology or organization.

In re-examining the appropriateness of its strategic orientation and its harmonization with the development of its surroundings, the retail company should combine the technology, as the exogenous factor, with the sales method as the internal factor. In that respect, the starting point is *Abell's* scheme which in the understanding of marketing strategies results from the realization that is not enough to simply list the products (objects) on the one side and state the market on the other side; instead it is necessary to further divide the business fields into: target groups, types of existing needs, i.e. functions, and technologies that will allow for the execution of the functions or, in other words, the satisfying of the needs of the targeted market segments (Müller – Hagedorn, 2005, p. 44–55).

Technologies in the retail trade are important for the chosen sales methods in respect to: (a) taking up the contact between the buyer and retailer, and (b) the service and charging method. This means that newer technologies enrich the sales methods.

As a complementary strategy to the retail trade with permanent location (the so-called stationary retail trade) the electronic trade or e-commerce constitutes a multichannel distribution and as such it is considered to be the success factor in the future (E-Commerce, 2005, p. 1).

As a newer sales method, Internet or the electronic retail trade has a considerable development potential, and therefore it is a serious option for every retail company. Nevertheless, it is considered that the Internet won't fully suppress the classic selling methods in foreseeable time and that markets will be, more or less, defined by the so-called multichannel strategies.

The growing importance of e-commerce is additionally supported, among other factors, by the expansion of the Internet in the sense of covering the whole territory and by the consumer behaviour in the use of media (Ewert&Kallenbrunnen, 2014, p. 42).

However, the fast development of purely Internet retailers shows that the stationary shop has not yet used all potentials of e-commerce to its favour. One of the reasons for that could be the too fast development in that line of work, because new possibilities, innovations and interaction are constantly discovered, and many

stationary retailers are too occupied with their daily businesses and are unable to follow these trends. Still, new information and communication technologies have made it possible to create new formats of retail operating units (Ewert&Kallenbrunnen, 2014, p. 43).

Depending on the level of observation, retail technologies can be classified into: (a) technologies on the shop level, (b) technologies on the company level, and (c) technologies in relations between companies. These technologies mostly relate to modern information systems and their use in the implementation of certain business conceptions.

Among many information and communication technologies that have been introduced in the consumable goods industry, the following technologies crystallized themselves as most important: electronic data interchange (EDI), the line coding and scanning (optical reading) technology, Radio Frequency Identification technology (RFID), and supplies management systems. (Klock, 2010, p. 36 ff).

### **2.3. Marketing and Logistic Views of Space and Technology in the Retail Trade**

The analysis of selling surfaces in particular countries shows that these surfaces are constantly growing. One of the main reasons for such fast growth of selling surfaces is the retailer's effort to meet as many needs and wishes of his buyers as possible through a comprehensive offer of articles. Since the retail trade must choose article for its assortment, the selling space may become a "bottleneck". Aside from this, in the usage of sellingspace the retailer must also deal with the problem of determining the place on the shelf for each article (cf. Klock, 2010, p.10).

Determining places on the shelves for particular articles is the task of the modern business conception of "category management (CM). That is, modern information and communication systems have made it possible to successfully connect activities along the logistic chain thus allowing for cooperation between the retail and production company.

Based on such conditions, new business conceptions have been created. Within the CM conception there is co-operative management of selling actions, assortment and product development, and selling surfaces management is also dealt with (Klock, 2010, p.35).

In fact, in the CM theory and practice space management is an activity inseparable from the assortment management, because retailers must choose from the variety of products offered to them by manufacturers or suppliers. Apart from the needs and wishes of the consumers, this choice also arises from the limitations imposed by the size of the selling space in retail trade (cf. Segetlija&Dujak, 2013, p. 89).

In the manufacturer – shop – consumer logistic system, information and communication systems are unavoidable precondition for the implementation of modern logistic conceptions, which aim at successful management of multipoint logistic systems and chains that surpass company boundaries. This means the management of supply chains. The attempt to integrate marketing and logistic efforts has led to the conception of efficient consumer response (ECR) and other conceptions based on ECR: the conception of collaborative planning, forecasting

and replenishment (CPFR) and the conception of optimal shelf availability (OSA) (Klock, 2010, pp. 35 and 36).

## 2.4. Development of New Formats of Retail Operating Units

Together with new information and communication technologies, new formats of retail operating units have developed as well (Ewert&Kallenbrunnen, 2014, p. 43). As it has already been emphasized, these new formats of retail operating units certainly include e-retail trade (online retail trade, Internet retail trade). In fact, Internet retail trade is an integral part of new formats of retail operating units (Segetlija, 2010).

The appearance of e-retail trade has been accompanied by the appearance of the so-called multichannel trade. Multichannel trade in the widest sense describes mutual communication with buyers, business partners and the company's own collaborators and different ways of communication by means of the Internet technology (Ladwig, 2002, p. 16). The concept itself generally also includes non-technological ways of communication; however, here it is limited mostly to the use of Internet based solutions (Ladwig, 2002, p. 179).

Accordingly, formats of the operating units in Internet retail trade relate both to "pure" Internet retail trade and to the use multiple selling channels, so that there are the following business models (Gittenberger&Vogl, 2014, p. 6):

- (a) pure Internet trade (pure player) with an online shop
- (b) stationary retail trade with a shop and an online shop
- (c) consignment trade (mail order and an online shop).

Such business models are described as multichannel retailing or multichannel distribution systems.

Business models relate to the use of modern information and communication technologies in the interaction with business partners. Namely, individual characteristics of trade operating unit forms differ both in the operating unit format as well as in the company's personality (type of operating unit). These characteristics amalgamate in the concept of "business model" (Merkel&Heymanns, 2003, p. 2).

Specific characteristics of modern retail trade relate not only to the use of modern information and communication technologies, but also to organizational and co-operational forms of retail companies in which competitive advantages come to expression due to the economy of size (large surface shops, affiliate companies and the like). These specific characteristics of modern retail also relate to successful management of processes, i.e. of value creation chains.

At the present day's level of development of online retail trade, it can be said that buyers are becoming a constituent part of a large "intelligent touch-point management" (Celko&Jánszky, 2014, p. 10). Digitally networked consumers have caused a true revolution in the trade. Today, networked consumers want to be able to buy goods everywhere and at any time (Die Chance Omnichannel, 2014).

This has led to the so-called omnichannel retailing. Omnichannel retailing can be described as the providing of an integrated and consistent buying experience for buyers who want to buy goods through all possible distribution channels (shops,

web, mobile-devices, games, social networks, kiosks, direct mail, catalogues, blogs, calling centres, television) at any time (cf. Kalakota, 2012).

Omnichannel retailing has evolved from multichannel retailing primarily because the buyers/consumers have changed as well, having become more demanding. It is therefore considered that omnichannel retailing is sometimes cost ineffective (and even impossible) without RFID-technology (Hardgrawe, 2012).

What is important for omnibuyers when they are buying goods is the recognisability of the retailer's brand (they do not want to worry about potential channels). Here, a very important role is plaid by mobile-devices (especially by the so-called smartphones) (cf. Kilcourse, 2011).

### **3. ANALYSIS OF THE SELECTED INDICATORS OF DEVELOPMENT AND OF THE EFFICIENCY OF RETAIL TRADE**

In the analysis of the development of retail trade from the spatial point of view it is common practice to use the indicator of selling surface per 1 inhabitant. This indicator will be presented graphically for the year 2013 for the Republic of Croatia and the selected European countries. Furthermore, for the Republic of Croatia, the changes of this indicator will be presented for the period from 1984 to 2009.

In the analysis of development of retail trade from the technological point of view, the following indicators will be used:

- (a) shares (in %) of retailing by mail order or via Internet in the total retail trade (retail trade, except for trade in vehicles and motorcycles, division 47)
- (b) shares (in %) of persons who have bought /ordered goods or services for personal use via Internet in the last three months.

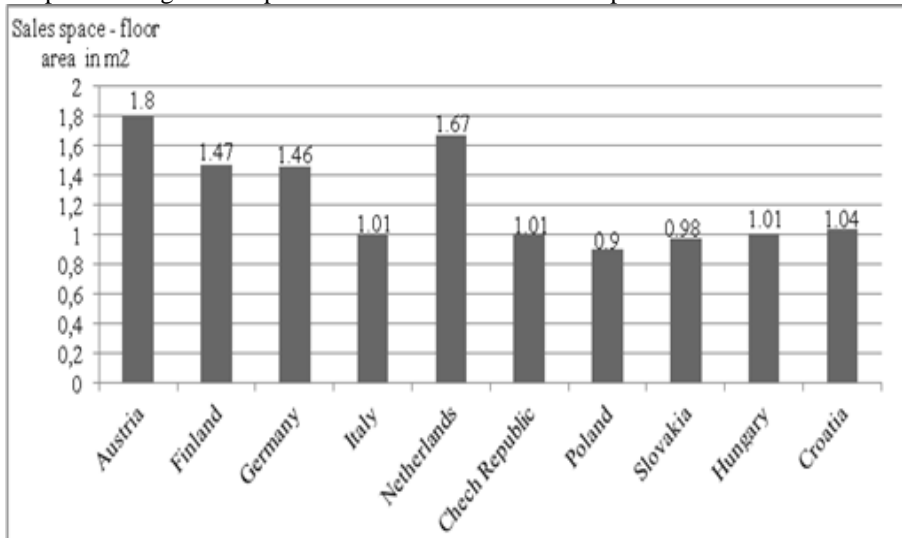
These indicators for selected European countries will be analysed and presented graphically.

For the analysis of the efficiency of retailing the usual indicator of turnover per 1 m<sup>2</sup> of selling surface will be used. As a new indicator of efficiency of selling surface, the indicator of the realized total gross domestic product (GDP) will be used for each of the countries per unit of selling surface (cf. Segetlija, 2011).

#### **3.1. Selling Surface per 1 Inhabitant**

Graph 1 presents the selling surface (of retail trade) per 1 inhabitant in selected countries.

Graph 1 Selling surface per 1 inhabitant in selected European countries in 2013

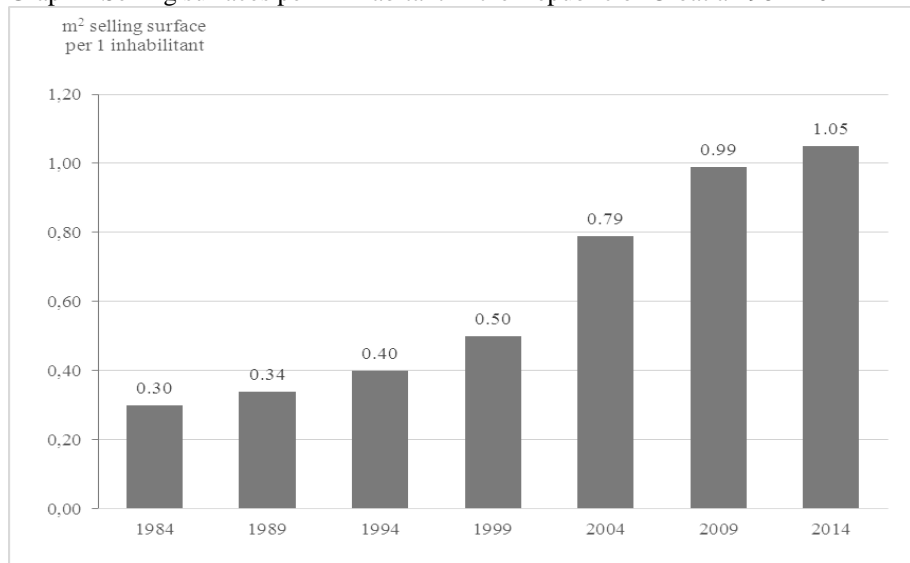


Source: GfK 2014, in: Einzelhandel Europa 2014, April 29, 2014

From graph 1 it is visible that economically and market developed countries (except Italy) have relatively larger selling surfaces. This is the result of the greater purchasing power and better retail offer. Furthermore, there are also some differences between individual economically and market developed countries. So Austria, for example, because of its density of shopping-centres, is more developed than Germany (Die Verkaufsflächendichte ist gestiegen – wie lange noch?, 2014). For the coming years these countries are expected to show stagnation in the development of selling surfaces.

In the Republic of Croatia in the last thirty years or so the selling surface per 1 inhabitant has increased by about 3.5 times. The changes in the selling surface per 1 inhabitant in Croatia from 1984 to 2014 are presented in graph 2.

Graph 2 Selling surfaces per 1 inhabitant in the Republic of Croatia 1984–2014



Notes: (a) without the selling surface of kiosks and petrol stations

(b) evaluation for 1994, 1999 and 2014

Source: (a) xxx (1991). Prodajni kapaciteti u trgovini na malo u 1989, Dokumentacija 809, Republički zavod za statistiku, Zagreb (Selling capacities in the retail trade in 1989, Documentation 809, Republic Department for Statistics, Zagreb, 1991)

(b) xxx (2006). Prodajni kapaciteti u trgovini na malo u 2004, Statistička izvješća 1293, Državni zavod za statistiku, Zagreb (Selling capacities in the retail trade in 2004, Statistical reports 1293, Croatian Bureau of Statistics, Zagreb, 2006)

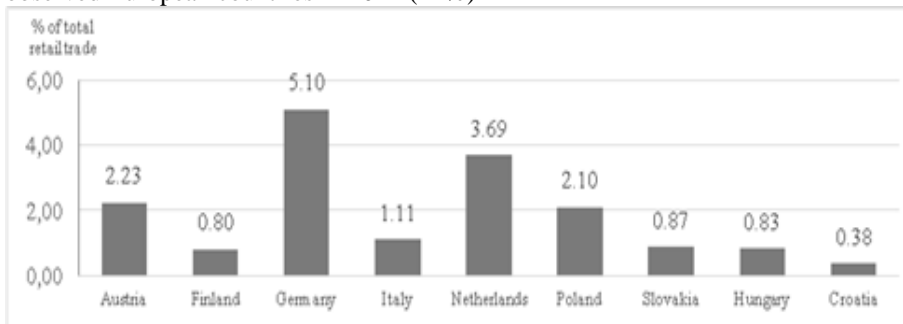
(c) xxx (2011). Prodajni kapaciteti u trgovini na malo u 2009, Priopćenje br. 4.1.3. od 28.4.2011, Državni zavod za statistiku, Zagreb, 2011 (Selling capacities in the retail trade in 2009, Information no. 4.1.3. from April 28, 2011, Croatian Bureau of Statistics, Zagreb, 2011)

(d) xxx (2014). Einzelhandel Europa 2014, GfK Studie zu den Handelsindikatoren 2013 und Prognose für 2014, April 2014 (Retailing in Europe 2014, GfK Study of Trade Indicators in 2013 and Forecast for 2014, April 2014).

### 3.2. Retail Trade through Mail and Internet

Graph 3 presents the shares of retailing through mail and the Internet in total retail trade (retail trade with the exception of motor vehicles and motorcycles, division 47) for the year 2011 in observed European countries. Due to the upswing of online retail trade, these shares are considerably higher in 2013.

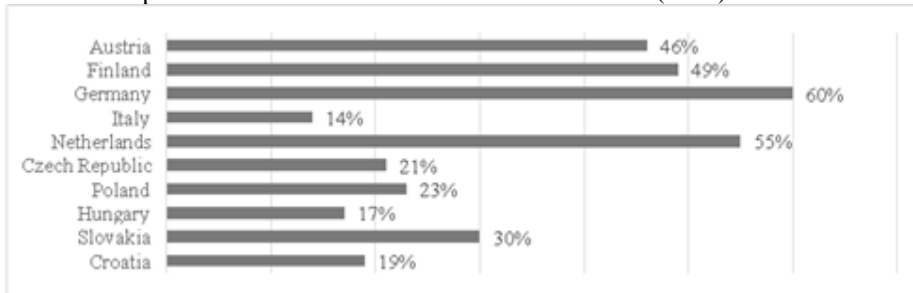
Graph 3 Shares of turnover via mail or the Internet in the total retail trade in observed European countries in 2011 (in %)



Source: Eurostat (2014). *Annual detailed the enterprise statistics for trade (NACE Rev. 2 G) [sbs\_na\_dt\_r2]*.

Graph 4 shows the shares of persons who have bought /ordered goods or services for private use via Internet in the last three months (of 2013). As well as in the share in purchasing via Internet, these shares of Internet buyers are considerably smaller in the transition countries than in economically developed European countries.

Graph 4 Shares of the number of persons who have bought/ordered goods or services for private use via Internet in the last three months (2013)



Source: Eurostat (2014). *Internet purchases by individuals*.

### 3.3. Productivity and Total Efficiency of the Selling Surface

Graph 5 shows the productivity of the selling surface, i.e. the realized turnover in the retail trade per 1 m<sup>2</sup> of selling surface in selected European countries.

It can be observed in graph 5 that the productivity of the selling surface in retailing is the highest in Finland, Poland, Croatia and the Czech Republic, whereas in more market-developed countries the productivity of the selling surface is lower. The presented indicators are the result of different retail structures and models. However, all countries show a declining tendency in the productivity of the selling surfaces and a decrease in the level of their utilization, because the retail surfaces are growing faster than the retail turnover.

Graph 5 Retail turnover per 1 m<sup>2</sup> of selling surface in selected European countries in 2010



Note: Recalculated into the purchasing power standard (PPS)

Source: (a) xxx (2011). Key European Retail Data 2010 Review and 2011 Forecast, *Directions Magazine, Articles*, June 30<sup>th</sup> 2011

(b) Eurostat (2012). *Gross Domestic Product as Market Prices, Purchasing Power Standard per Inhabitant* – Statistics Database.

(c) Eurostat (2012). *GDP per capita - Annual Data* - Statistics Database.

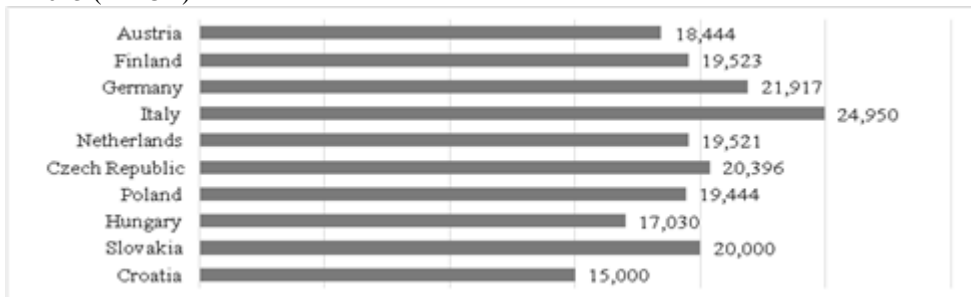
(d) Eurostat (2012). *Population at 1 January*, Most popular database tables.

However, regardless of the somewhat better utilization of the selling surface in the transition countries, the overall efficiency of the retail trade (in the sense of the realization of GDP for the whole country per unit of selling surface) in the transition countries is significantly lower than in economically and market developed European countries. This means that retailing in the transition countries has not sufficiently included manufacturers of goods and services from these countries into their supply chains. The reasons for such tendencies, however, are not in the lack of selling surfaces but rather in the technical-technological underdevelopment of domicile retailers in the transition countries.

The realization of the GDP per 1 m<sup>2</sup> of selling surface in observed European countries in 2013 year has been presented in graph 6. It can be observed in the graph that Croatia and Hungary lag behind in total efficiency of the selling surfaces (in respect to total economic performances expressed in the GDP).



Graph 6 Realized GDP per 1 m<sup>2</sup> of selling surface in the selected European countries in 2013 (in EUR)



Source: (a) Eurostat (2014). *Gross domestic product the at market prices, Purchasing Power Standard per Inhabitant*

(b) GfK 2014, in: xxx (2014). *Einzelhandel Europa (Retailing Europe) 2014*, April 29, 2014

#### 4. INSTEAD OF THE CONCLUSION

The problems relating to business premises in the retail trade are of special importance, because the retail trade development in a particular country can be expressed by means of the indicators of relative size of selling surface, and the efficiency of retail trade can be measured by the realized retail turnover per unit of selling surface.

However, not only the relative size of the selling space is important for the evaluation of development of retail trade in the particular country – very important are also the indicators about the usage of modern technologies. Therefore the development of retail trades in that sense can be evaluated, for example, according to the share of online retailing in the total retail trade, or also according to the number of persons who have bought/ordered goods or services online within a specified period of time. Of course, technological aspects also play a role in the realization of retailing efficiency. Technology is important for the development of new formats of retail operating units, where intelligent connecting of elements in the formatting of a stationary shop with elements of online retailing especially comes to expression. In this way the multichannel, and even the so-called omnichannel retailing are developed.

Modern technological solutions must be used to allow the development of retailing in the sense of the functioning of successful retail supply chains. Thus the retailers also influence the realization of the total GDP in a particular country.

In the analysed transition countries one can observe a boom of selling surfaces. Productivity of the selling surface in the observed transition countries in 2010 did not lag behind the productivity in the observed economically and market developed countries. However, in some of the transition countries (Croatia, Hungary) the realized GDP in the total economy per unit of selling surface is relatively low. This means that the total efficiency of retail trade in the economy, in respect to the size of selling surface, is not satisfactory.

## 5. REFERENCES AND SOURCES OF INFORMATION

1. Ahlert, D. & Kenning, P. (2007). *Handelsmarketing*, Springer Verlag, Berlin – Heidelberg, 2007.
2. Berning, R. (2002). *Prozessmanagement und Logistik*, Cornelsen Verlag, Berlin.
3. Celko, M. & Jánosky, S. G. (2014). *Die Zukunft des stationären Handels, Trendstudie des 2baHEAD Think Tanks*, Leipzig, 2014 [available at: [http://www.2bahead.com/trendstudien/zukunft\\_des\\_stationaeren\\_handels](http://www.2bahead.com/trendstudien/zukunft_des_stationaeren_handels), access May 10, 2014].
4. Cox, R. & Brittain, P. (1990). *Retail Management*, Pittman Publishing, London, 1990
5. Dibb, S., Simkin, L., Pride, W. M., Ferrel, O. C. (1995). *Marketing*, Translation of English edition (1991), Mate, Zagreb.
6. Dujak, D. (2012). *Uloga maloprodaje u upravljanju opskrbnim lancem*, Doctoral Dissertation, Josip Juraj Strossmayer University of Osijek, Faculty of Economics in Osijek.
7. Eurostat (2012). *Gross domestic product at market prices, Purchasing Power Standard per Inhabitant Eurostat - Statistics Database* [available at: <http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=tec00001&plugin=1>, access March 19, 2012].
8. Eurostat (2012). *GDP per capita - Annual Data*, Statistics Database [available at: [http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namaaux\\_gph&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namaaux_gph&lang=en), access March 23, 2012].
9. Eurostat (2012). *Population at 1 January, Most popular database tables* [available at: <http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=tps00001&tableSelection=1&footnotes=yes&labeling=labels&plugin=1>, access March 20, 2012].
10. Eurostat (2014). *Annual detailed enterprise statistics for trade (NACE Rev. 2 G) [sbs\_na\_dt\_r2]* [available at: <http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do>, access: June 25, 2014].
11. Eurostat (2014). *Internet purchases by individuals* [available at: [http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc\\_ec\\_ibuy&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=isoc_ec_ibuy&lang=en), accessed: June 25, 2014].
12. Eurostat (2014). *Gross domestic product at market prices, Purchasing Power Standard per Inhabitant* [available at: <http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=tec00001&plugin=1>, access June 25, 2014]
13. Ewert, Ch. & Kallenbrunnen, K. (2014). Potenziale des E – commerce für den Einzelhandel, *markeZin – Die Karlsruher Marketing Zeitschrift*, Heft 5, Februar 2014, pp. 41 – 54 [available at: [http://www.w.hs-karlsruhe.de/markezin/links/Markezin\\_Heft5\\_A4Klaus%20Kallenbrunnen.pdf](http://www.w.hs-karlsruhe.de/markezin/links/Markezin_Heft5_A4Klaus%20Kallenbrunnen.pdf), access June 24, 2014]
14. Gittenberger, E. & Vogl, B. (2014). *Intrernet-Einzelhandel 2014*, KMU Forschung Austria, Austrian Institute for SME Research, Wirtschaftskammer Österreich –Bundessparte Handel, Bundesministeriums für Wissenschaft,

- Forschung und Wirtschaft, Wien [available at: [https://www.wko.at/Content.Node/branchen/w/Download/Internet-Einzelhandel\\_2014.pdf](https://www.wko.at/Content.Node/branchen/w/Download/Internet-Einzelhandel_2014.pdf), access May 27, 2014].
15. Hardgrave, B. (2012). Omnichannel Retailing: You can't do it without RFID, *RFID Journal*, [available to: <http://www.rfidjournal.com/articles/view?10247> , access March 25, 2013].
  16. Hasty, R. & Reardon, J. (1997). *Retail Management*, McGraw-Hill Companies, Inc., New York a.o.
  17. Kalakota, R. (2012). *Multi-channel to Omni-channel Retail Analytics: A Big Data Use Case* [available to: <http://practicalanalytics.wordpress.com/2012/01/19/omni-channel-retail-analytics-a-big-data-use-case/> , access March 25, 2013].
  18. Kämpf, R., Növig, T., Yesilhark, M. (2008). *Supply Chain Management* [available at: <http://www.ebz-beratungszentrum.de/logistikseiten/artikel/scm-1.htm>, access March 28, 2008].
  19. Kilcourse, B. (2011). *Gaming Google: The Growing Importance of Omni-Channel* [available at: <http://www.rsresearch.com/2011/03/01/gaming-google-the-growing-importance-of-omni-channel/>, access March 23, 2013].
  20. Klock, S. (2010). *Verkaufsflächennutzung im Einzelhandel*, University of Bamberg Press [available at: <http://d-nb.info/1012672077/34> , access June 13, 2014]
  21. Ladwig, F. (2002). *Multi-Channel Commerce im Vertrieb*, Betriebswirtschaftliche Verlag Dr. Th. Gabler, GmbH, Wiesbaden.
  22. Lerchenmüller, M. (1992). *Handelsbetriebslehre*, Friedrich Kiehl Verlag GmbH, Ludwigshafen, Rhein.
  23. Lerchenmüller, M. (2003). *Handelsbetriebslehre*, Friedrich Kiehl Verlag GmbH, Ludwigshafen, Rhein.
  24. Levy, M. & Weitz, B. (2007). *Retailing Management*, Sixth Edition, McGraw-Hill, Company Inc.
  25. Mandel, J. (2011). *Modell zur Gestaltung von Build-to-Order-Produktionsnetzwerken*, Doctoral Dissertation, Fakultät für Konstruktion-, Produktions- und Fahrzeugtechnik der Universität Stuttgart, Institut für Industrielle Fertigung und Fabrikbetrieb der Universität Stuttgart, [available at: [http://elib.uni-stuttgart.de/opus/volltexte/2012/7647/pdf/Mandel\\_Diss.pdf](http://elib.uni-stuttgart.de/opus/volltexte/2012/7647/pdf/Mandel_Diss.pdf), access June 8, 2013]
  26. Mason, J.B. & Mayer, M. L. (1990). *Modern Retailing*, Fifth Edition, Richard D. Irwin, Homewood, Boston.
  27. Merkel, H. & Heymans, J. (2003). *Geschäftsmodelle im stationären Einzelhandel* [available at: <http://www.imC-ag.com/artikel/Festschrift-03-02.pdf>, access April 10, 2005].
  28. Müller-Hagedorn, L. (2005). *Handelsmarketing*, Vierte Auflage, Verlag W. Kohlhammer, Stuttgart.
  29. Segetlija, Z. (2006). *Trgovinskoposlovanje*, Faculty of Economics in Osijek.
  30. Segetlija, Z. (2010). *e-maloprodajakaosastavnicanovihoblikamaloprodajnihposlovnihjedinica*, *Suvremenatrgovina*, Vol. 35, No. 2/2010, pp. 14 – 19

31. Segetlija, Z. (2011). Problemu činkovitostimaloprodajnihoblikautranzicijskimzemljama, *Suvremenatrgovina*, Vol. 36, No. 6/2011, pp. 22 – 29
32. Segetlija, Z. & Dujak, D. (2013). *Upravljanje kategorijama proizvoda*, Faculty of Economics in Osijek
33. Sikavica, P. & Novak, M. (1999). *Poslovnaorganizacija*, 3<sup>rd</sup>exchanged and amendededition, Informator, Zagreb.
34. Xxx (2014). Die Verkaufsflächendichte ist gestiegen – wie lange noch?, *RegioData*, Wien [available at: <http://www.regiodata.eu/de/die-verkaufsfl- chendichte-ist-gestiegen-wie-lange-noch>, access June 13, 2014].
35. Xxx (2011). 2010 The 250 Global Retailers, *Stores Magazine*, January 2011 [available at: <http://www.stores.org/2010/Top-250-List>, access July 17, 2011].
36. Xxx (2014). *Die Chance Omnichannel*, Deloitte eBay [available at: <http://www.lebensmittelzeitung.net/studien/pdfs/622.pdf>access June 21, 2014]
37. Xxx (2005). *E – Commerce* [available at: <http://www.handelswissen.net/data/themen/ Marktpositionierung/ betriebsform/Distanz...> , access December 25, 2005].
38. Xxx (2014). Einzelhandel Europa 2014, *GfK Studie zu den Handelsindikatoren 2013 und Prognose für 2014*, April 2014 [avilable at: <http://www.lebensmittelzeitung.net/studien/pdfs/640.pdf>, access June 25, 2014].
39. Xxx (2011). Key European Retail Data 2010 Review and 2011 Forecast, *Directions Magazine*, Articles, June, 30<sup>th</sup> 2011. [available at: <http://www.directionsmag.com/articles/key-european-retail-data-2010-review-and-2011-forecast/186736>, access July 30, 2011].
40. Xxx (1991). Prodajni kapaciteti u trgovini na malo u 1989, Dokumentacija 809, *Republički zavod za statistiku, Zagreb* (Selling capacities in the retail trade in 1989, Documentation 809, *Republic Department for Statistics*, Zagreb, 1991).
41. Xxx (2006). Prodajni kapaciteti u trgovini na malo u 2004, Statistička izvješća 1293, *Državni zavod za statistiku, Zagreb* (Selling capacities in the retail trade in 2004, Statistical reports 1293, *Croatian Bureau of Statistics, Zagreb*, 2006).
42. Xxx (2011). Prodajni kapaciteti u trgovini na malo u 2009. Priopćenje. Br. 4.1.3. *Državni zavod za statistiku, Zagreb*, 28. Travnja, 2011 (Sales Capacities in Retail Trade in 2009, First Release No. 4.1.3., *Croatian Bureau of Statistics, Zagreb*, 28 April 2011 [available at: <http://www.dzs.hr>, access June 21, 2014].

## **LOGISTICAL CHALLENGES AND POTENTIALS IN MULTI-CHANNEL FOOD RETAILING & DISTRIBUTION**

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*Scientific paper*

### ***Abstract***

Manufacturer's concepts for direct supply to food retailers have already been replaced in the 1970s by establishment of logistical supply networks and concepts. The development of IT-based enterprise resource planning systems and the design of efficient networks of stores consequently led to higher availability and improved service levels for consumers. Although the management of logistics costs always remains challenging within existing supply processes, e-commerce adds another new challenge. Existing goods supply processes in store-based retailing will be complemented by additional goods flows from online sales, in future. Studies increasingly show the relevance of multi-channel retailing: consumers' loyalty rises, unless additional information and distribution options in food retailing are available online. However, food retailers in Austria only recently start opening online distribution channels by providing deliveries of food and hygiene items in own dedicated web-shops. Reasons for that corresponding restraint are diverse: (i) very high store density, (ii) high level of consumer satisfaction with current store-based concepts and (iii) the not yet fully developed handling of logistical procedures and infrastructure in food online processing (e.g. packaging, cooling, etc.). It is necessary to adapt existing supply processes in food retailing to be able to handle the „last-mile“ cost- and time-efficient. The main aspect in terms of these challenges for efficiently logistics processing in online retailing is the creation of optimum synergies with existing supply processes. In the underlying research, a derived holistic view of various requirements of distribution structures identifies

corresponding potential: the role of end consumers in the network is as considered as the predominant process structures and possible last-mile concepts for online distribution in Austrian food retailing. A resulting two-stage potential-rating regards the consumer side as well as retailer-side aspects in order to determine the important economic dimensions and logistics capabilities of different supply concepts.

**Key words:** retail supply, distribution, logistics concepts, online retail

## 1. INTRODUCTION

Online sales revenues from digital grocery shopping in our economy and our daily lives do not belong to the past any longer. An offered web-service on top of traditional stationary food retailing is the next evolutionary step in this industry sector. Grocery retailers modify their strategies: they incorporate the growth of internet penetration in order to develop online shopping with ready pick-up or free shipping options. As shoppers look for more opportunities, they are more likely to have the choice to purchase their grocery products – as they already do it with books or software – online, as well. The way consumers shop online is influenced by social media channels, on which humans are stimulated and incentivized through product promotion and information, by now. A fact, that retailers are expected to react on (Strang, 2013, p. 32-35). The e-commerce, exactly the one topic that incorporates these major developments in grocery retail operations, therefore causes an innovative process of noticing, adapting and changing an additional channel for retailers, to offer and distribute products to end consumers. There, e-commerce accompanies a big business-to-consumer development – in many industry sectors and consequently also within the grocery industry. And when talking about the electronic commerce, it is further beyond (i) consumer's acquisition of information or (ii) retailer's transmission of marketing messages: it is about buying and selling via the internet next to traditional stationary retailing (Burt/Sparks, 2003, p. 275-276). Several food retailers offer online services, as dedicated web-shops, in more or less limited form while others serve with consumer oriented order processing for in-store pick up or home delivery services. In order to gain economies of scale, retailers are challenged with the build-up of the necessary process infrastructure, sales and delivery concepts both on the traditional and online value stream (Murphy, 2007, p. 947-948). Whilst mentioned concepts of online order-based food distribution to consumer's doors in certain countries (e.g. US, UK, France, The Netherlands, etc.) show progress for some time already, online food retailing in Austria is in its early stages. Recent developments of e-business models in the food retailing industry in Austria go further than experimenting with online-based sale processes. Regional retailers are about to apply their grocery sector experiences for the establishment of new communication channels, sales-streams and fulfilment processes. Different organizational modes combined with a multi-channel strategy in food retailing, open up a new market and yield to both new value streams and new consumer groups within the grocery sector.

## **2. METHODOLOGY & BACKGROUND**

### **2.1. Methodical approach**

This research covers the mentioned food retail distribution process on a regional perspective in Austria. The relevant structural and organizational measures in adapting traditional and existing logistics processes in food retailing with online-food retail streams are investigated in the following methodical sequence: (1) identification of traditional retail distribution processes, (2) definition of requirements and influencing factors for online retail distribution, (3) elaboration of online retail distribution options and (4) description of retailer's and end consumer's specifics including projection of trends.

Presented data are derived from both literature research and qualitative data collection through workshops with involved practitioners and food retail industry specialists among an Austrian expert circle. Especially in terms of an applied research methodology, that cooperative approach allows both researchers and industry stakeholders to commonly analyze and discuss possible options for process modification and integration in grocery distribution. Diverse aspects and obtainable variants referring the potential of existing food retailing processes have been elaborated to boost development in the online/e-commerce value stream within the Austrian grocery sector.

### **2.2. Traditional retail distribution processes**

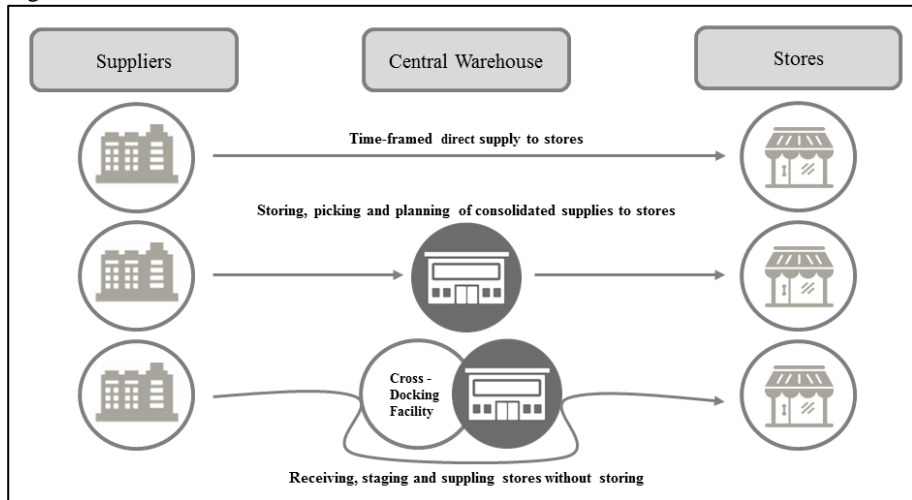
Today's consumers often take it for granted to have products available for purchase in stores all the time, as fresh as expected, right after launch-date as well as in sufficient quantity. Considering the mentioned e-commerce development, the same attitude towards food products quality and availability will expect no change. Consumers will demand full product availability and soon extensively supply in terms of home delivery services (Ferne/Sparks, 2004, p. 2-5).

Considering traditional retailing and the established logistics and distribution processes, requirements that come from high e-commerce demands which require, that supply or logistics systems (that deliver goods from the industry to warehouses and stores for consumption) are to be transformed or at least to be extended. Retailers focus on process development especially in secondary distribution (stores are supplied from warehouses), by channeling an increasing transport volume through DCs (distribution centers) and supporting logistical operations through the use of ICT (Information and Communication Technology). Reduced inventory at every level and improved efficiency in transport utilization, handling and packaging are central results of that strategic progress (Ferne/Sparks, 2004, p. 3-5).

Taking existing traditional retail distribution processes under consideration, a set-up of additional online food retail processes for fulfilling consumer demands is closely linked with a main established basis of processes (e.g. direct supply, central warehouse supply or cross docking – see figure 1).



Figure 1 Traditional Retail Distribution Processes



Source: own figure based on literature sources

### 2.2.1. Direct Supply

In direct supply, the control of the goods-flow is done by the manufacturers, as they coordinate deliveries to stores in accordance with time frames specified by the retailers (Bretzke, 2010, p. 380). The concept is mainly suitable for fast moving products with large order volumes, or if the supplier sells a broad and deep product range in the store, since there is the chance for high transport capacity utilization. Furthermore, it is suitable for perishable goods, that have to be delivered to the stores quickly, as well as for high-priced items that would result in high capital tied-up. In addition, this kind of distribution process would be worth considering if the goods require the use of special means of transport (e.g. container) due to their specifics (Laurent, 1996, p. 206; Thonemann et al., 2005, p. 77). The coordination costs for deliveries to stores can be uncomfortably high, in case the number of coordinating transport routes increases. Basically, all suppliers and CEP (courier express parcel) service providers must have sufficient high logistics expertise to coordinate distribution processes to the stores. However, this is not always the case in practice. Flexibility regarding demand fluctuations is limited because the supply frequency is lower than for the central warehouse concept (Stölze 2004, p. 68 & 71).

### 2.2.2. Central warehouse supply

Complexity in supply networks can be significantly reduced by consolidation of goods and information flows. A reduced number of transport relations that needs to be managed, is one reason leading to this effect. In earlier times, relations between several suppliers and as much stores had to be coordinated which resulted in high numbers of distribution connections to be coordinated. With a central warehouse concept, transport relations can be reduced. Suppliers ship all goods to a



central warehouse. After consolidation of goods, the transport is carried out with a minimum of vehicles to stores. The concept results in a reduced number of deliveries and further to a reduction of logistical activities in the stores (Hertel/Zentes/Schramm-Klein, 2011, p. 172; Liebmann/Zentes, 2001, p. 638).

### *2.2.3. Cross Docking*

Total logistics costs can be reduced through efficient cross docking (either “single-stage” or “multiple-stage” cross docking), since in most cases less storage space is required within central warehouse premises. Furthermore, the process costs can be reduced through the elimination of warehousing processes. In addition, inventory costs are avoided because stock levels are kept by the manufacturer. Demand fluctuations in stores can - similar to the central warehouse concept - be out-balanced one below the other. Furthermore, the cross docking approach requires less investment, as storing procedures (as well as additional storage technology) at the transition point is indispensable. In addition, there will be a consolidation of goods flows in the on carriage/last mile, resulting in less ramp contacts at the stores. Due to the efficient delivery, no stocks need to be kept in the stores (Hofer, 2009, p. 149; Placzek, 2007, p. 137).

In the grocery sector in general, the interlinkage between existing and new mentioned processes is of high priority in terms of cost- and time-efficient processing. With regard to mentioned existing supply processes in stationary food retailing in general, several linked requirements and potentials of distribution concepts for handling e-commerce need to be considered. The aim for developing facts for a common process for distribution processes joining both, (1) stationary retailing and (2) e-commerce streams, where synergies in operating both channels can be realized.

## **2.3. Requirements and influencing factors in terms of online retail distribution**

When considering e-commerce demands as a new value stream in food retailing, requirements for adapting existing supply processes in food retailing for incorporating online retail distribution are two folded: on the one hand, (1) relevant process options, in connection to existing distribution in food retailing, need to be identified; (2) the criteria on the retailer's and the end consumer's side also need to be given strong consideration (Schramm-Klein/Morschett, 2005, p. 6-9; Ehrlich, 2011, p. 43).

As valid for both, internet consumers and stationary retail consumers, the end consumer requirements mainly include delivery time, freshness of products, shipping costs, the shopping procedure and convenience factors. In contrast to that, the retailers look more precisely on investment costs, process infrastructure (including stock levels), process adaptations and synergies (including time and personal resources) and handling times (Emrich, 2009, p. 57-61).

With a regional economic view of the Austrian grocery sector, additional influencing factors on both sides: the (i) total turnover in Austrian grocery, (ii) number of stores with e-commerce facilities, (iii) assortment policy in food online

concepts (iv) available time for residents (v) monthly budget of private households (vi) payment ability for grocery products, completes a broad consideration of requirements and influences on the based e-commerce development.

When relevant process options and specifications for online retail distribution are shown and evaluated (see chapter 3 – Findings & Results), the retailer's as well as the end consumer's specifics and influencing factors are put into the context with potentials and trends in food distribution processes.

### 3. FINDINGS & RESULTS

#### 3.1. Online retail distribution options

Based on the above mentioned traditional retail distribution processes, an exchange and preparation workshop with involved practitioners and industry experts (based on stated distribution models from an A.T. Kearney study, 2012, p. 3) resulted in conceivable options for distributing online ordered grocery goods; the methodical approach yielded to two "direct delivery" and two "click & collect" types of distribution:

##### PoS picking & direct delivery

According to consumer orders, goods are picked at the store (point of sale) by PoS-staff and distributed as home delivery. Delivery could be effected by CEP service providers or PoS-staff.

##### DC or „Online-DC“ picking & direct delivery

Picked goods at the DC or „Online-DC“ (newly built DC with precise requirements for the specific online food retailing processes) are distributed as a home delivery. Delivery could be effected by CEP service provider or by PoS-staff alternatively. Due to expected high distances between central warehouse and consumer's home addresses, delivery ought to be handled by a parcel service efficiently – e.g. when considering order bundling.

##### PoS picking & Pick-up ("click & collect" option 1)

Picked goods at the PoS are provided in given pick-up stations for collection by the end consumers. The retailer can determine whether the pick-up is possible at any time or only after shop-opening hours.

##### „Online-DC“ picking & Pick-up („click & collect“ option 2)

Picked goods at the "online-DC" are provided in given pick-up stations at the "online-DC" for collection. This service concept can be offered 24 hours a day, in case where the pick-up station access system is suitable or staff is available for physical handover.

While "click & collect"-concepts are considered to be the retailer's easiest entry opportunity into online food retailing business, the more challenging are "direct delivery"-concepts (with which field trials in an ongoing retail research project in Austria deals with), not least because of certain prerequisites in processing and margin modelling.

### 3.2. Retailer's and end consumer's specifics

Challenges in online retail distribution are further dependent on existing specifics of parties involved:

The consumer-side specifics incorporate facts that are very important for consumers in today's e-commerce business. Those can be divided into specifics either for online consumers or for consumers in stationary food retail. The "*delivery time*" (time span between order and delivery or availability of the products at the point of sale or at the pick-up station) and the "*freshness of the products*" rank among the most important criteria for online consumers. "*Shipping costs*", "*shopping procedures*" (whether consumers can shop undisturbed and smooth) and "*convenience factors*" complete consumers' attitudes. Product availability is important for both consumer groups and most often taken for granted.

Identified retailer-side specifics are of economic importance regarding implementation or adaption of multi-channel food retailing. Therefore, that requires first and foremost "*investments*", as they proportional cause higher risk for the retailer. In case of failing in the e-commerce business, the high investments in infrastructure by the retailer can cause severe liquidity problems or even bankruptcy. Further factors contain necessary "*process adaptations*" (linked with substantially high time and personal resources), the realization of "*potential synergies*" (at best contributing significantly to cost reduction) or finally, the "*picking efficiency*" are economically most relevant cost drivers for the grocery retailing company.

Table 1 Rating of Online Retail Distribution Options compared with Stakeholder's Specifics

Distribution Option Retailer's & Consumer's Specifics	PoS & <i>direct delivery</i>	DC or Online- DC & <i>direct delivery</i>	PoS & <i>Pick-up (click &amp; collect 1)</i>	Online-DC & <i>Pick-up (click &amp; collect 2)</i>
C / delivery time	+	+	~	~
C / freshness of products	+	+	~	~
C / shipping costs	+	+	-	-
C / shopping procedures	+	+	~	~
C / convenience factors	+	+	~	~
R / investments	~	~	~	~
R / process adaptations	+	~	~	~
R / potentials synergies	~	~	-	~
R / picking efficiency	-	+	-	+

Source: own research based on qualitative workshop data

Table 1 shows a process rating in terms comparing given stakeholder specifics with potential *impact* and *necessity* ("+" rather high, "~" medium, "-" rather low), in each respective constellation. It is recognizable that the "direct delivery"-concepts have high impact on the consumer specifics, as direct/home delivery process touches end consumers' shopping habits in a more decisive manner than the "click &

collect”-options. Any new “DC”-option is characterized by high investments but high potential picking efficiency and process/synergy potential, especially in case of adapting an existing DC for e-commerce processes. Furthermore, “click & collect”-concepts stand for low risk – as they have only medium impact on consumer specifics – but are more uncertain for the retailer-side, especially regarding process adaptations and potential synergies with existing operations.

In contrast to the particular distribution level, a broader view on the economic sector, as stated above, results in the following: Table 2 enfolds additional influencing factors and their rating in terms of *impact* (“+” strong, “~” medium, “-” low/no effect”) on identified distribution options in online food retailing.

Figure 2 Rating of Additional Influencing Factors in Online Food Retailing

... effect on... Influencing factor...	Total turnover in Austrian grocery	Number of stores with e-commerce facilities	Assortment policy in food online concepts	Available time for residents	Monthly budget of private households	Payment ability for grocery products
Total turnover in Austrian grocery		-	-	-	-	-
Number of stores with e-commerce facilities	+		+	~	-	-
Assortment policy in food online concepts	+	~		~	-	~
Available time for residents	-	~	~		+	+
Monthly budget of private households	+	-	+	-		+
Payment ability for grocery products	+	-	-	-	-	

Source: own research based on qualitative workshop data

The higher the monthly budget of private household, the more probability for higher value spent on grocery products. This is partly related to the payment ability for food, with an equivalent rise in food retails sales for a higher total turnover in the regional grocery market. The number of “e-food-stores” as well as the assortment policies stand for an additional sales channel in the food retail sector and do mainly

– but not negligible – influence total grocery turnovers. Finally, available time for residents affects private household budgets and the payment ability (assuming: more working times imply a rise in income).

As the resulting two-stage potential-rating evolved through practitioners and specialist workshops and include assumptions regarding development and dependencies between certain factors on the Austrian food retail market. Yet, the presented effect ratings have shown interesting impacts in course of planning high-performing distribution processes for the online food market segment.

#### 4. CONCLUSION

Due to recent changes in consumer attitudes towards e-commerce business models, the focus in the food retail sector has shifted from serving end consumers in traditional stores to offering additional distribution options in connection with online sales. There is much potential to change stationary grocery business practices and its distribution system. However, the dimensions on the process level when adapting changes are yet uncertain. Online retail distribution options – apart from those shown above – will vary geographically, corporately and on a logistics level. Aside from the logistical point of view, a consideration of economic factors allowed a brief insight into relevant aspects on market potentials for the Austrian online grocery business. That resulted in the two-stage potential-rating regarding retailer's and end consumer aspects on the given topic.

Inefficiencies and the relatively high delivery costs faced by consumers as well as retailers in terms of purchasing and selling grocery goods online, are of high priority. A key issue in terms of e-commerce development in food retailing concepts is the satisfactory completion of consumers' online purchases. Consumers will always expect an inexpensive, quick, reliable and convenient delivery of purchased products.

A study by McKinsey & Company indicates a strategic and operative logistics concept as the most decisive aspect in developing online food retailing. Increasing sales volumes and demand fluctuations due to an additional e-commerce value stream require managerial tasks to ensure goods availability. A specific logistics structure is the basis and more important than any other communication or marketing strategy (McKinsey & Company, 2013, p. 24-30). In addition to that, convenience and reliability are central aspects for e-commerce consumers. Process quality and price levels, which are strongly influenced by the logistics concept quality, are considered as the most decisive aspects.

#### 5. REFERENCES

1. A.T. Kearney (2012). Online-Food-Retailing – Nischenmarkt mit Potenzial. Konzepte, Herausforderungen und Marktpotenzial für den Handel in Deutschland, Düsseldorf, [available at:

2. [http://www.lebensmittelzeitung.net/studien/pdfs/396\\_.pdf](http://www.lebensmittelzeitung.net/studien/pdfs/396_.pdf), accessed: 10-06-2014]
3. Bretzke, W.R. (2010). Logistische Netzwerke, 2.Auflage, Berlin Heidelberg.
4. Burt, S. and Sparks, L. (2003). E-commerce and the Retail Process. A Review, Journal of Retailing and Consumer Services, Vol. 10, pp. 275-286.
5. Ehrlich, O. (2011). Determinanten der Kanalwahl im Multichannel-Kontext, 1. Auflage, Wiesbaden.
6. Emrich, C. (2009). Multi-Channel-Management: Gestaltung einer multioptionalen Medienkommunikation, 1. Auflage, Stuttgart.
7. Fernie, J., Sparks, L. (2004). Logistics and Retail Management: Insights into Current Practice and Trends from Leading Experts.
8. Hertel, J., Zentes, J., Schramm-Klein, H. (2011). Supply-Chain-Management und Warenwirtschaftssysteme im Handel, 2.Auflage, Berlin Heidelberg.
9. Hofer, F. (2009). Management der Filiallogistik im Lebensmitteleinzelhandel – Gestaltungsempfehlungen zur Vermeidung von Out-of-Stocks, 1.Auflage, Wiesbaden.
10. Laurent, M. (1996). Vertikale Kooperation zwischen Industrie und Handel: Neue Typen und Strategien zur Effizienzsteigerung im Absatzkanal: In: Tietz, B. (Hrsg.): Zukunft im Handel. Band 5. Frankfurt a. M.
11. Liebmann, H.P. and Zentes, J. (2001). Handelsmanagement, 1.Auflage, München.
12. McKinsey & Company - The future of online grocery in Europe, 2013, [available at: [http://www.mckinsey.com/client\\_service/retail/latest\\_thinking/perspectives\\_second\\_edition/~/\\_media/CB4608C559E34B3FBEDDAEC82AD72470.ashx](http://www.mckinsey.com/client_service/retail/latest_thinking/perspectives_second_edition/~/_media/CB4608C559E34B3FBEDDAEC82AD72470.ashx), accessed: 09-06-2014]
13. Murphy, A., J. (2007). Grounding the Virtual: The Material Effects of Electronic Grocery Shopping; Geoforum Vol. 38, p. 941–953.
14. Plaszek, T.S. (2007). Optimal Shelf Availability. Analyse und Gestaltung integrativer Logistikkonzepte in Konsumgüter-Supply Chains, 1. Auflage, Wiesbaden.
15. Schramm-Klein, H. and Morschett, D. (2005.). „Multi Channel Retailing“, Journal of Internet Banking and Commerce, Vol.10, No.1, pp. 1-12.
16. Stölzle, W., Heusler, K.F., Karrer, M. (2004). Erfolgsfaktor Bestandsmanagement – Konzept, Anwendung, Perspektiven, 1. Auflage, Zürich.
17. Strang, R.(2013). Retail Without Boundaries, Supply Chain Management Review, p.32-39, November 2013.
18. Thonemann, U., Behrenbeck, K., Küpper, J., Magnus, K.H. (2005.): Supply Chain Excellence im Handel: Trends, Erfolgsfaktoren und Best-Practice-Beispiele, 1.Auflage, Wiesbaden.

## **RETAIL READY PACKAGING – WHAT'S IN IT FOR FOOD MANUFACTURERS?**

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*Scientific paper*

### ***Abstract***

Process of concentration in retail market, as well in Croatia as in other European countries, has insured for retailers stronger negotiating position in fast moving consumer goods supply chain, especially in food chain. Retailers have initiated retail supply chain management - a lot of different cost efficiency processes in food supply chain which they were able to force with their suppliers, usually with the absence of an equitable distribution of savings that this collaboration enables. One of these is development of retail ready packaging for food products, designed from manufacturers' side with main intention to reduce in store labour cost for stacking products on shelves. Goal of this paper is to investigate if food manufacturers can, and how, turn retail ready packaging into their own advantage instead of looking to this trend only as a factor that causes partly higher production cost.

Paper analyses supply chain and marketing aspects of change from ordinary packaging to retail ready packaging. Questionnaire study in Croatian food manufacturing companies was conducted, that revealed some potential for improvement of manufacturing echelon of supply chain when it comes to retail ready packaging. On-line questionnaire was distributed to all Croatian food manufacturing companies that manufacture products sold in retailing.

Research has shown positive connection between size of a company and degree of its retail ready adoption, as well as between start of significant RRP implementation and entrance of foreign retail chains in Croatia. RRP influence three kinds of costs for manufacturers, and main benefits of RRP for manufacturers are focused on shelf visibility, product image and relationships with retailers.

Regarding research limitations, study was conducted only in Croatian companies, and sample does not cover equally all branches of food industry. Regional survey would give a clearer view on retail ready packaging relationships in international food supply chains.

Paper clearly indicates contemporary relationships between retailers and manufacturers in food supply chain regarding retail ready packaging, where retailers demonstrate all their capabilities drawn from retail supply chain management. Additionally, paper argues that there is a good possibility for manufacturers to use advantages of retail ready packaging mostly from its advertising function as well from certain supply chain possibilities.

**Key words:** retail ready packaging, food supply chain management, food production industry, food retail trends

## 1. INTRODUCTION

Today it is normally taken for granted that any product of our choice is available in almost any supermarket. The issue how the good came to that particular supermarket is not something that a modern consumer is concerned about, neither he nor she should be. To be able to maintain this status in consumer mind, the supply chain as a whole had to involve the development of integrated supply chain management and also to ensure that channels of distribution and supply chains are both anticipatory (if appropriate) and reacting to consumer demand, at general and detailed segment levels (Fernie & Sparks, 2009). Fast moving consumers goods (FMCG) market, due to continuous process on concentration, development and acceptances of new technologies from the side of retailers, has been now more than ever driven by the largest retail chains. Today, retailers are the active designers and controllers of product supply in reaction to known customer demand. They control, organize and manage the supply chain from production to consumption (Fernie & Sparks, 2009, p. 9).

As a consequence, many authors talk about retail supply chain management – RSCM (Ray, 2010; Gustafsson et al., 2009; Alagiri & Selvan, 2007, Ayers & Odegaard, 2008; Finne, & Sivonen, 2009). Understanding of this term may be twofold (Segetlija, Mesarić & Dujak, 2012): a) the retailing supply chain management, or b) managing the supply chain by retailers.

In the case of the retailing supply chain management, term simply implies carrying out activities of supply chain management (SCM) in retail economic operator (mostly logistics activities).

RSCM as a managing of supply chain by retailers describes supply chain situation in which retailers takes a keyword in the supply chain initiating SCM



activities with other members, and in some ways acting as one who actually manages the whole (or most) of the supply chain. Through the growing dependency of other members, power of retailers increases significantly. In food supply chains retailers continually conduct SCM activities that are directed toward other members of the supply chain, and which usually result in significant degree of control of the entire supply chain by retailers. Those activities are primarily directed to their suppliers, but also to final customers - mainly through category management activities as a way of retail demand management (Segetlija, Mesarić, Dujak, 2013).

Through RSCM retailers were introducing many supply chain innovations and tools which are primarily designed to improve retailer's business, but also the supply chain as a whole. Most of them are made and introduced by food retailers - regional distribution centres in 1960s and 1970s, outsourcing of logistics activities, development of reusable transport packaging, conversion of warehouse in sales area in 1980s, cross-docking, in-store Internet delivery, Efficient Consumer Response (ECR) development, factory gate pricing in 1990s and 2000s (Gustafsson et al, 2009, p. 45). RSCM field of packaging in particular, in recent years is witnessing successful use of roll containers, rigid plastic packaging, retail ready packaging, one touch packaging or "forkable" display units. Also, there are even more sophisticated innovations in forms of active and intelligent packaging options (Dobrucka, 2013), not rarely associated to Radio Frequency Identification (RFID) technology (Gustafsson et al, 2009, p. 213-214).

One of tools that retailers have introduced to improve efficiency in their supply chain is so called Retail Ready Packaging (RRP) or Shelf Ready Packaging (SRP), mainly designed to reduce in-store labour cost for stacking products on shelves. As the negotiating power of retailers grows larger towards its suppliers, suppliers gradually have to equip their products with RRP, even though it almost always means higher production cost.

In spite of the fact that RRP is not enough studied in scientific and professional literature, its advantages for retailers are well known. This paper turns to manufacturer's point of view. Long-term sustainable SCM is necessary to be based on an equitable distribution of savings and other benefits that are achieved through this type of collaboration in the supply chain. Therefore, the goal of this paper is to turn the perspective and investigate RRP from food manufacturers' point of view, to find advantages that food manufacturers can benefit from by turning them into their favour, and categorized them.

In order to find those advantages the survey among Croatian food manufacturers has been conducted.

## **2. LITERATURE REVIEW**

### **2.1. Retail Ready Packaging**

Retail ready packaging (RRP) is a form of transit packaging designed not only for transportation purposes, but also to ease and facilitate the process of in-store replenishment (supply chain function). As a secondary packaging, it is packaging

where the actual products are being shipped in from the manufacturer to the retailer (Schrijver, 2013, p. 6). But in the same time, RRP is packaging that enhance the shopping experience for the consumer (Pira International, 2011) and this way benefits all supply chain members (marketing function). RRP allows goods to be moved direct to the point of sale with minimal handling, and to be easily collapsed and disposed of ready for recycling (Coles, 2013, p.199). Simple packaging is being replaced by, essentially, more complicated packaging to make activities in store easier and more efficient.

Although sometimes identified with Shelf Ready Packaging (SRP) because of its most important function, RRP is broader term that encompasses different kind of packaging like shelf ready packaging, display ready packaging, replenishment ready, infrastructure ready or shopper ready packaging (IGD Supply Chain Analysis, 2011; Korzeniowski, 2009). In 2005 The Institute of Grocery Distribution and Efficient Consumer Europe UK proposed that "shelf ready packaging" should be used as a term for a product that comes ready-merchandised and that can be placed directly on to a shelf. "Retail ready packaging" is their term for additional aspects of easy identification and easy packaging opening, but where the outer case is moved direct to the shelf following "one-touch replenishment" principles (Gustaffson et al, 2009, p. 210).

Retail ready packaging impacts all echelons in supply chain from its production echelons downstream, therefore it is very important that every activity of supply chain is considered by manufacturer, transportation and retailer, in order to make RRP as efficient as it can be. For example, it is crucial that packaging designers are directly (first-hand) acquainted with the store operations of employees who will stack goods on the shelves or on stores' floor. Otherwise, the situation may occur in the store where the time of shelving RRP even extends over time needed for shelving traditional packaging (Fisher & Raman, 2010, p. 136), resulting in other expected positive impacts of RRP to be reduced.

It is difficult to precisely determine the time of first appearance, i.e. the first development of RRP's, as it was coming in different forms. What is certain is a fact that retailers oriented on its costs and final customer, primarily hard discounters, have recognized potential for improvement of traditional packaging. In their everlasting quest for ways of cutting cost to ensure the lowest possible price, hard discounters have recognized opportunities for savings through RRP's - primarily reducing the time needed to replenish the shelves (i.e. reducing in-store labour costs). It can be concluded that RRP, in today's forms, first entered European stores in early 2000s - but even before there were RRP attempts. Some authors (Creedy, 2010) see German hard discounter Aldi as a pioneer of RRP due to his use of pallets or boxes (that products are delivered on by the supplier) as display units in their stores. When it comes to retail assortment - „nearly 100 percent of discounters' products use RRP, compared with only about 40 percent of non-discounters“ (Warschun, 2011). According to The Institute of Grocery Distribution, UK retailer Tesco is the pioneer in using RRP. In 2005 Tesco started to organize RRP meetings with their consumer packed goods suppliers. After that, The Institute of Grocery Distribution has done the same with Sainsbury's UK and in the following years

continued with their activities all over the world, from Baltic to Australia and North America (Reynolds, 2010).

Regardless of which retailer was the first to introduce the RRP, the reasons of occurrence of RRP in European discounters are manifold:

- Need to cut in-store labour costs (highest retailers' cost and retailers are faced with high employee turnover<sup>6</sup>) through faster products replenishment;
- Traditionally smaller stores than in USA<sup>7</sup> required more frequent deliveries and smaller packages to avoid out-of-stock (OOS) situations<sup>8</sup>;
- Environmental benefits – easier to disposal, less need for paper in RRP solutions (if done properly), and less product waste (Wheeler, 2012).

From Europe (Germany and United Kingdom), RRP started its journey all across the world (Figure 1). The presence of RRP on stores shelves is quite different among countries and continents. Responsible for that is the cost of the labour. RRP first has been applied among European retailers, especially in the North West and Central Europe, where the labour is more expensive than in other parts of Europe or other continents, for example North America (Finne & Sivonen, 2009, p. 194). After Europe, successful implementation has been conducted in North and South Americas, and especially in Australia, but their implementation is spread more slowly in comparison to Europe.

Efficient Consumer Response (ECR) published their first Retail Ready Packaging Toolkit in 2006 where the five RRP functional requirements were specified (ECR Europe, 2006, p. 15): Easy Identification, Easy Open, Easy Dispose, Easy Shelf and Easy Shop. Five easy of RRP primarily benefit to retailer during in-store operations. Easy identification also benefits to manufacturer (and possible wholesaler) but not significantly different than in case of traditional transit packaging (ECR Europe, 2006, p. 6).

RRP can be made from solid fireboard, rigid plastic or metal, but according to Smithers Pira's study (Pira International, 2012), titled 'The Future of Retail Ready Packaging to 2017', more than three-quarters of the total volume of materials used in 2011 in the world is corrugated board. One more study concluded that we can expect growth of RRP use in the world at a CAGR (Compound Annual Growth Rate) of 3.57 percent over the period 2013-2018 (Infiniti Research Limited, 2014).

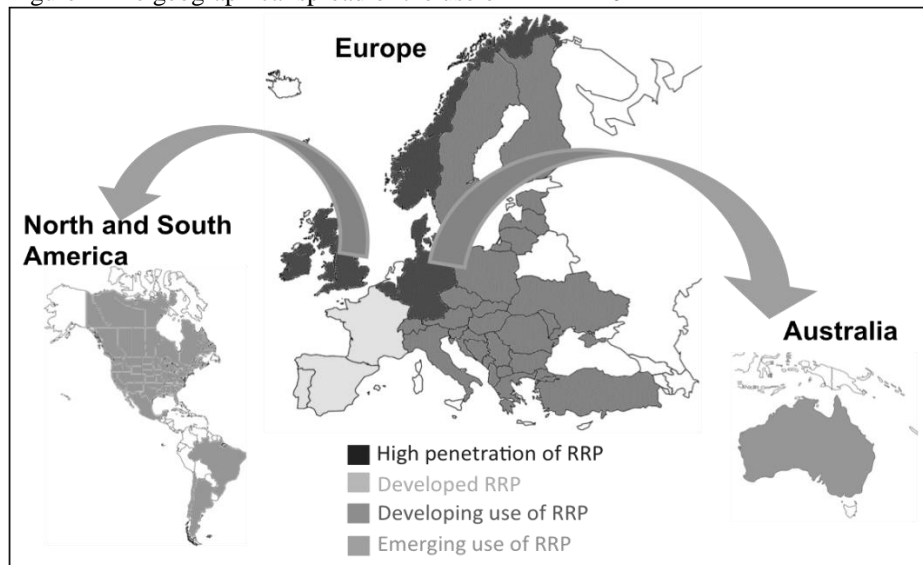
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<sup>6</sup>According to Segetlija & Dujak (2013, p. 112) employee turnover in retailing on store positions can reach even 300 % annually

<sup>7</sup>European household sizes are smaller and life styles are different so Europeans shop at smaller stores with more frequent shopping (Arzoumanian, 2011, p. 24)

<sup>8</sup>OOS in retailing retail represents a situation where there is no product on the shelf/refrigerator or sales stand

Figure 1 The geographical spread of the use of RRP in 2011



Source: authors according to (IGD Supply Chain Analysis, 2011)

Regarding RRP types, ECR Europe (2006, p. 14) classifies all RRPs in three types: shelf RRP, merchandising RRP and re-usable RRP.

Main benefits of RRP can be investigated in the store itself, and there IGD (IGD Supply Chain Analysis, 2011) finds considerable number of advantages:

- More accurate stock counting and order generating,
- Less product damages through case cutting,
- Faster identification of products in back room,
- Increased speed in building promotional displays,
- Faster spotting of stock by replenishment teams,
- Faster stocking of shelves,
- Reduced damages, shrink and waste,
- Reduce time to train new staff,
- Less double handling of stock,
- Improved code rotation,
- Faster code checking.

In high scale environment of large international retailers, absence of different kinds of box cutters is also significant advantage – according to Arzoumanian (2011, p. 25) RRP drastically reduces injury risk from box cutters and eliminates or minimizes product damage from box cutters.

According to Verghese et al. (2013, p. 37) RRP reduce product waste as well, because of more efficient stock rotation by increasing sales (through better visibility and availability) and increasing the speed of replenishment (less out of date

situations). Even more effects of product waste reduction can be seen in using reusable RRP solutions (reusable crates, display pallets and fractional pallets).

In many cases, RRP is of lighter weight than traditional packaging what causes less material needed to manufacture it, as well as easier manipulation during product replenishment.

## **2.2. Retail ready packaging and food manufacturers**

All these benefits should be accomplished with one major goal – to increase sale through its higher on-shelf availability resulting for higher sale and profit both for retailer and manufacturer. And this is the way retailers usually present to manufacturers a need for RRP implementation. Hence, RRP can be classified as a type of retailers' SCM collaboration initiative (part of RSCM). This initiative can be expressed directly by retailers, or indirectly through necessity arising from competition of other manufacturers who have had direct request of retailers. Either way, cost of implementing RRP packaging is almost always and exclusively on manufacturers.

Majority of RRP are used for food products (nearly 78%) and beverages (16%), and non-foods counts for only 6% in 2010 (Pira International, 2012). In the scientific literature most RRP studies are in the field of fresh food packaging, where the need for this type of packaging is the greatest (Jeyamkondan et al., 2000; Stubbs et al. 2002; Eilert, 2005; Walsh & Kerry, 2012; Venturini et al., 2006; Ranade, 2008). The problem that food manufacturers in Europe and USA (Arzoumanian, 2011), as well in Croatia, usually emphasize is a lack of fair distribution of benefits that result from RRP. Regardless of the increased sales, the introduction of RRP usually leads to an increase in the cost of packaging for manufacturer, while significantly reducing in-store costs at retailers. Fair distribution of achieved savings or costs caused by RRP would represent incentive for further SCM collaboration. Research from United Kingdom has shown that almost half manufacturers in 2006 do not manage to return its investment in RRP, but they still do it "to remain competitive and maintain good customer relationships" (Food Manufacture, 2006).

As this subsequent SCM cooperation does not usually happen in the food supply chain (due to retailers' power), the manufacturer is left only to focus on the benefits of RRP that can lead to the quicker and significant increase in sales (primarily for retailer and then for manufacturer). In this way, its investment can be quickly restored. These benefits are:

- More opportunities for advertising in the store than traditional packaging;
- Opportunities to strengthen the image of its own brand;
- Smaller packages can enable the eventual availability in a larger number of stores (even in smaller stores);
- If done properly RRP can decrease need for packaging material;

First two benefits of RRP are of marketing nature, while next two are supply chain issues.

Improved brand recall and awareness can be achieved through larger surface of packaging that is exposed to the views of shoppers in the store making it more noticeable. According to Schrijver (2013), RRP also insures greater product

visibility. While OOS situation for products without RRP (only in primary packaging) will result with empty shelf, RRP products in OOS situation will leave RRP packaging in place in front of the shelf with manufacturers' message for shopper on it. Schrijver (2013, p. 37-38) has proved that designed elements of RRP in certain degree re-enforce brand message as well as primary packaging, but manufacturer should ensure that design matches with brand attributes. Similar conclusion about product recognition has been made in ECR Europe study (2006, p. 12).

It is easier to entry on the overcrowded shelf at retailers' store with the smaller package, especially in the case of food products regarding their best before dates. It also gives a chance to category manager to duplicate product position in the store, if the store policy allows it. Neighbourhood stores with smaller sale surface are again opening in the centres of towns on attractive locations (e.g. traditionally large surface retailers like Spar and Billa in Croatia), so smaller packages are necessity, due to limited space.

American food manufacturer Kraft claims that through the use of RRP for its Philadelphia cream cheese managed to save more than 362 tons of paper packaging in a year. These results require large investment in packaging design, whereby the main challenges are concerning proper board strength and accurate pressure of the perforated rule for safety in supply chain and ease of opening in retail store (Mohan, 2012).

According to Korzeniowski's research (2009), not negligible advantage of RRP is the fact that most customers prefer it. In the comparison with primary individual packaging, consumers in retail stores emphasize better design and features that make it easier to find a product on a shelf, as well as presenting a product in a way that is not creating any barriers while purchasing item.

### 3. METHODOLOGY

For the purpose of this paper research was conducted from June to August 2014 on Croatian food manufacturing companies. Base for the population and sample production was Register of Croatian Companies done by Croatian Bureau of Statistics for Croatian Chamber of Economy (Register of Croatian Companies, 2014). The study included Croatian companies that have met the 5 following criteria:

- Active company that is not in bankruptcy,
- Have at least one employee,
- Croatian founder,
- Type of organisation: Limited liability company or Joint-stock company,

- Activity code according to NACE2007<sup>9</sup>: C10 (Manufacture of food products) except C1071 (Manufacture of bread; manufacture of fresh pastry goods and cakes) under 51 employees<sup>10</sup>.

Population of 529 companies in Croatia meet these requirements and to all were sent e-mail with a link to the online survey (questionnaire). Questionnaire was aimed to find out food manufacturers' level of RRP adoption and time of first implementation. Also, it measured proportion of products with RRP in whole assortment with their proportion of turnover, level of change in costs associated with RRP, as well as main advantages of RRP for manufacturers. Research questionnaire was developed by adapting questions from previous RRP research (IGD Supply Chain analysis, 2011; ECR Italia, 2010; ), as well as on the basis of interviews with employees of Croatian large food manufacturer from packaging, logistics and marketing department.

Most research constructs were measured using multiple-item 5-point Likert scales. During the 6-week period questionnaire was sent 5 times, and a total 36 filled and valid questionnaires were received, which provide random sample with overall response rate of 6,81 % (Table 1). Answers were provided by logistical or marketing managers of companies. In Table 1 it is possible to see distribution of the companies in the sample in relationships to the distribution of the companies in the population, all arranged according to NACE 2007 classification. A sample represents population very well in almost all food industry categories, except in C109 (Manufacture of prepared animal feeds) where there is no respondents.

Table 1 Distribution of the companies in the sample and population according to different food industries (according to NACE 2007)

Food industry (NACE 2007)	Frequency	Share in sample (%)	Population	Share in population (%)
C101 Processing and preserving of meat and production of meat products	6	16,70	112	21,17
C102 Processing and preserving of fish, crustaceans and molluscs	2	5,60	33	6,24
C103 Processing and preserving of fruit and vegetables	3	8,30	56	10,59
C104 Manufacture of vegetable and animal oils and fats	2	5,60	40	7,56
C105 Manufacture of dairy products	4	11,10	58	10,96
C106 Manufacture of grain mill products, starches and starch products	2	5,60	40	7,56

<sup>9</sup>Statistical classification of economic activities in the European Community, abbreviated as NACE, is the nomenclature of economic activities in the European Union; the term NACE is derived from the French *Nomenclature statistique des activités économiques dans la Communauté européenne* (Eurostat, 2013)

<sup>10</sup> Companies under code C1071 with less than 50 employees (391 of them) are small bakeries that manufacture and sell on the same site and don't use RRP. Only LCFM and MCFM companies from C1071 possibly use RRP if they entered large retail chains with their products, and they are included in a sample.

C107 Manufacture of bakery and farinaceous products	4	11,10	74	13,99
C1081 Sugar manufacture	2	5,60	3	0,57
C1082 Manufacture of cocoa, chocolate and sugar confectionery	6	16,70	9	1,70
C1083 Processing of tea and coffee	1	2,80	37	6,99
C1084 Manufacture of condiments and other food supplements	1	2,80	9	1,70
C1089 Manufacture of other food products	3	8,30	32	6,05
C109 Manufacture of prepared animal feeds	0	0,00	26	4,91
Total	36	100,00	529	100,00

Source: survey

All companies were divided into 3 segments according to their size: large Croatian food manufacturers (LCFM) with more than 250 employees, medium Croatian food manufacturers (MCFM) with more than 50 and less than 251 employees, and small Croatian food manufacturers (SCFM) with more than 1 and less than 51 employees (Table 2).

Table 2 Characteristics of sample according to size of a company

Populations' segments	Population $N$	Sample $n$	Respondent rate $f = \frac{n}{N}$
LCFM (more than 250 employees)	31	18	58,06 %
MCFM (between 51 and 250 employees)	79	13	16,46 %
SCFM (between 1 and 50 employees)	419	5	1,19 %
Total	529	36	6,81 %

Source: survey

Stratified sample showed different response rates. Best response rate was in a LCFM (58,06 %), satisfactory response rate of 16,46 % was in a MCFM segment, and worst was in SCFM (1,19 %).

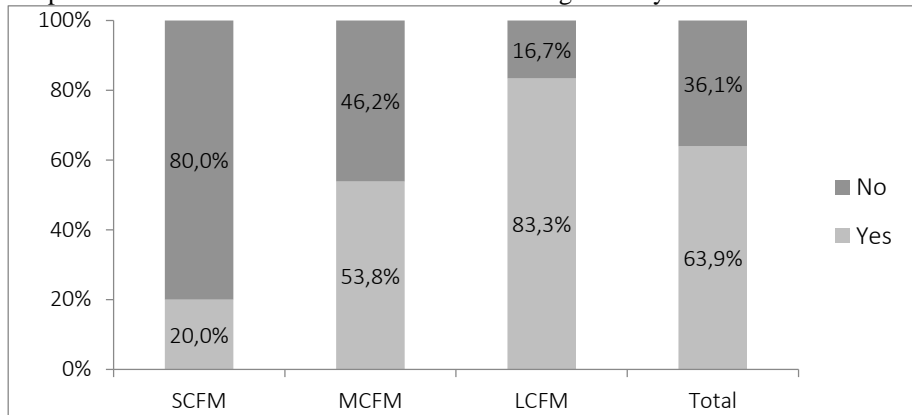
#### 4. RESEARCH RESULTS

Response rates correspond with the replies to the question about the use of RRP's. Specifically, 83,3 % of LCFM and 53,80 % of MCFM respondents use RRP packaging for their products, as compared to only 20 % of SCFM respondents (Graph 1). It can be concluded that larger companies are not only using more RRP,



but also more recognize the significance of RRP research and possibility of improvement of its use.

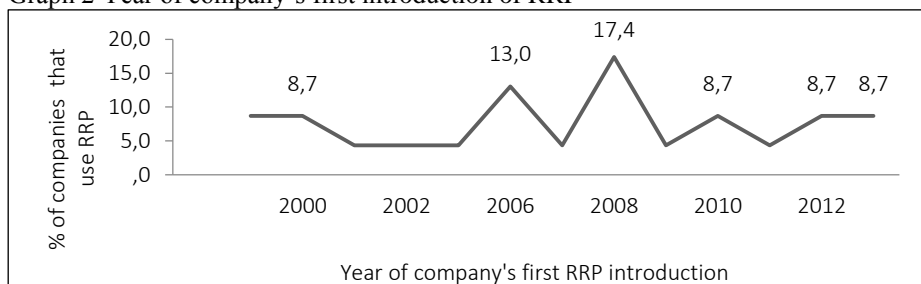
Graph 1 Use of RRP in Croatian food manufacturing industry



Source: survey

Graph 2 indicates time of first RRP introduction in respondent companies and highlights most important years of first RRP use in Croatian food production market. First significant pick can be traced to 2006 – year when German „hard discounter“ Lidl first entered Croatian retail market. This shows that Lidl didn't just enter on Croatian retail (mainly) food market, but as well on Croatian food production market (primarily through private labels done by Croatian manufacturers for Lidl). In this way Lidl has incorporated Croatian manufacturing companies in his supply chain, but also introduced foreign manufacturers and their supply chain characteristics to Croatian market. Due to intensifying competition, in 2008 other retailers are also beginning to demand RRP packaging, but also manufacturers themselves are introducing RRP in order to remain competitive.

Graph 2 Year of company's first introduction of RRP

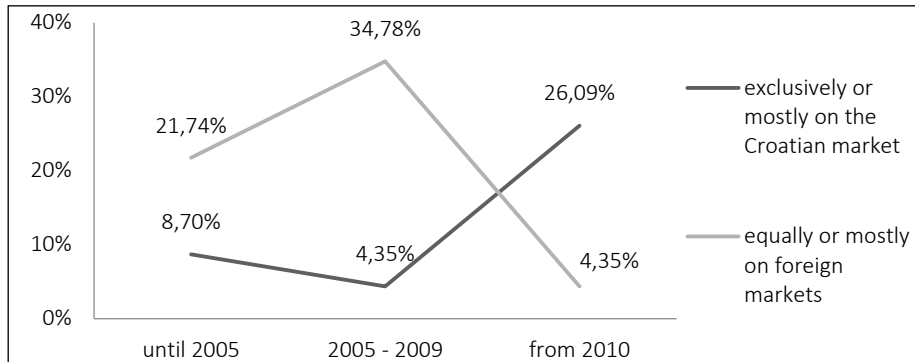


Source: survey

Graph 3 shows the relation between years of company's first introduction of RRP in relation to its prevailing sales market. We can conclude that Croatian food companies that sell their products mostly on foreign markets or equally on foreign

and Croatian markets, started to introduce RRP earlier than companies whose prevailing market is Croatian market. This is one more evidence that RRP as a technological innovation in supply chain, came to Croatia from international retail supply chains in a significant degree.

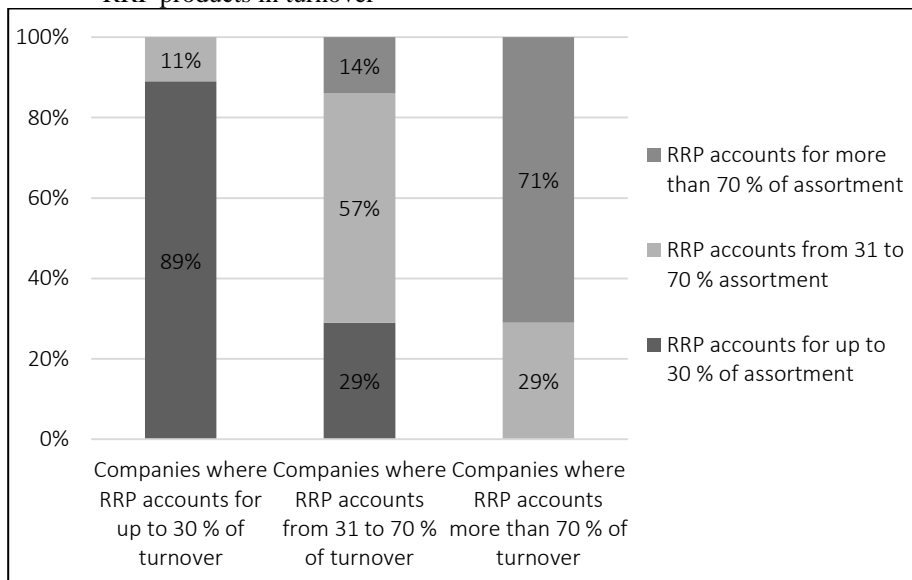
Graph 3 Year of company's first introduction of RRP in relation to its prevailing sales market



Source: survey

Another goal of research was to examine if there is a connection between proportion of products with RRP in whole product assortment, and proportion of products with RRP in whole manufacturers' turnover (traffic). According to Graph 4, 89 % of companies in which RRP accounts for up to 30% of turnover, also have up to 30% of RRP in assortment. Furthermore, 57% of companies in which RRP accounts from 31% to 70% of turnover have between 31% and 70% of RRP products in their assortment. But more importantly, 29% of companies achieve between 31% and 70% of turnover with assortment where RRP contributes with less than 30%. And finally, companies in which RRP accounts for more than 70% of turnover achieve these turnovers with same (71% of companies) or smaller (29% of companies) proportion of RRP in assortment. This leads to conclusion that usually share of RRP products in assortment is same or smaller, than share of same products in companies' turnover. In other words, RRP products generate same or higher turnover than traditional packaging.

Graph 4 Relationship between share of RRP products in assortment and share of RRP products in turnover



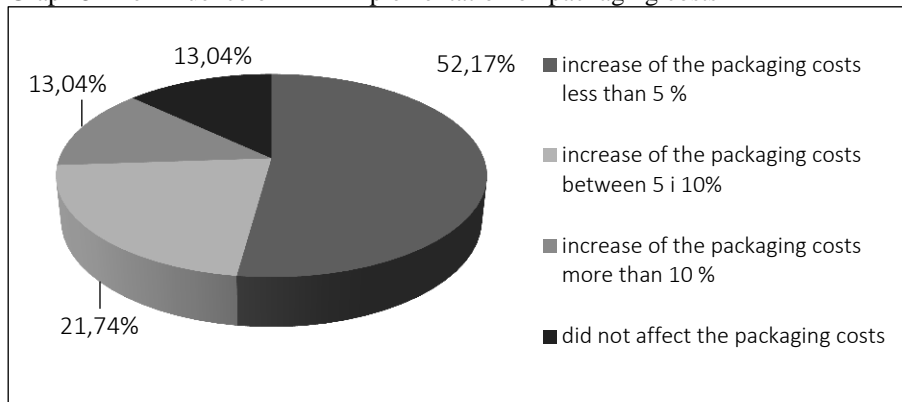
Source: survey

When it comes to costs caused by RRP, manufacturers have three kinds of costs to consider.

First cost to consider should be cost directly associated with preparation and starting of RRP implementation and it is mainly seen through investment in new packaging line equipment. Research indicates that 60,9 % of companies had to invest in packaging line equipment – 26,1 % of them had significant investment in the packaging line equipment (in most cases new packaging lines), and 34,8 % of them only had minor investment in adjusting of the existing packaging line. It is interesting that 39,1 % didn't have any investment in packaging line equipment, which leads to conclusion that they have outsourced its packaging line or changes on existing packaging line didn't require any additional investment.

Secondly, the cost of packaging itself in most cases changes with RRP implementation, and research shows that packaging cost increases in case of 87,48 % of companies (Graph 5). More than half of respondents reported increase less than 5 %, 21,47 % of them recorded increase between 5 and 10%, and 13,04 % of respondent companies recorded increase of packaging costs more than 10%.

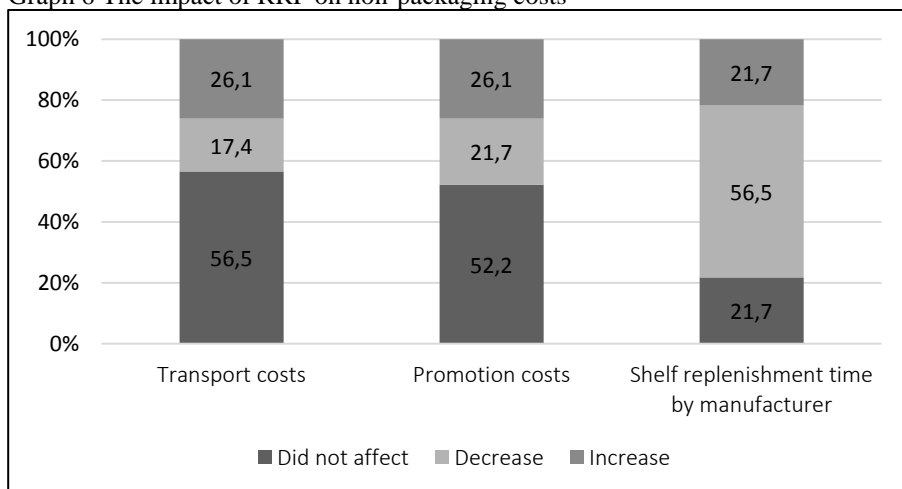
Graph 5 The influence of RRP implementation on packaging costs



Source: survey

Finally, there is a group of costs that are indirectly caused by RRP implementation. Through literature research and industry interviews three costs are identified that are changing under the influence of RRP – cost of shelf replenishment time by manufacturer, promotion costs and transport costs. As it is evident from Graph 6, only cost for manufacturers that has been significantly changed is cost of shelf replenishment time<sup>11</sup>, which decreased with RRP introduction in case of 56,5% of respondents who have introduced RRP packaging. Other two costs in case of more than half of respondents didn't change by RRP implementation.

Graph 6 The impact of RRP on non-packaging costs

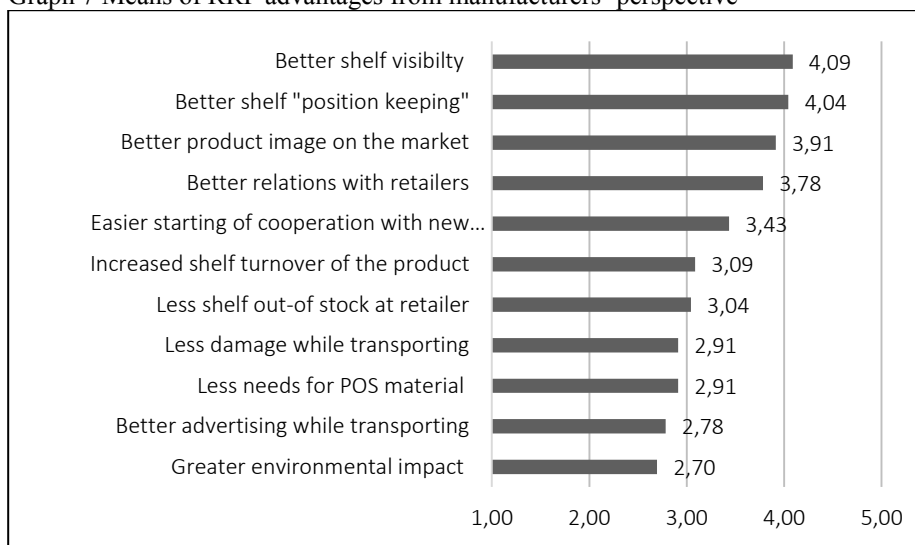


Source: survey

<sup>11</sup>This corresponds with the most significant advantage for retailers

By using 5-point Likert scale with 1-“Not advantage at all”, and 5-“Exceptional advantage” as anchors, key benefits of RRP for manufacturers has been examined and their means are presented in Graph 7. Manufacturers see better shelf visibility (mean = 4,09) and better shelf “position keeping” (mean = 4,04) as most important advantages of RRP, because they both directly positively influence noticeable of product (greater product visibility on shelf). For them is also important to improve product image on the market through RRP (mean = 3,91), and to improve relations with retailers (mean = 3,78) or to ease start of cooperation with new retailers (mean = 3,43).

Graph 7 Means of RRP advantages from manufacturers' perspective



Source: survey

Finally research has shown that 78,26 % of companies plan to increase (56,52 % of companies) or significantly increase (21,74 % of companies) share of RRP products in assortment within 1 – 3 years. 13,04 % of companies plan not to change share of RRP in assortment, and only 8,70 % plan to decrease share of RRP in assortment (and they are all MCFM). These results are consistent with forecasting research about further spread of RRP in world (Korzeniowski, 2009).

## 5. CONCLUSIONS

Today's food supply chain is more and more driven by large retailer. In their intention to answer consumer trends from one side and to cut down operating cost on the other side, retailers are developing different tools and/or operating systems under RSCM concept and Retail Ready Packaging is just one of tool in the range. Food manufacturers are aware that the benefits of RRP are mainly reserved for

retailers, but they are also willing to make the extra effort (and extra cost) just to stay in the game, or to improve their negotiating position. The main goal of this research was to look into RRP from the food manufacturers' perspective and to identify benefits on their side of value chain.

Research has shown a positive connection between size of Croatian food manufacturing company and growth of RRP use. Large Croatian food manufacturers have already implemented RRP to their business in very high percentage (83%).

Regarding RRP use, an international character of selling activities of manufacturers plays a major role. Croatian food manufacturers that are present on international markets (markets outside Croatia) implemented RRP before the one present only on Croatian market. Furthermore, RRP implementation in Croatia is highly driven by international hard discounters (most of Croatian food manufacturers implemented RRP in 2006-2008 period when Lidl entered Croatian market); same like on EU markets, which can be drawn as a parallel from previous research.

Research also concluded that in Croatia manufacturing industry, RRP products generate same or higher turnover than traditional primary packaging. It has been proven by results indicating that share of RRP products in assortment is same or smaller than share of same RRP products in companies' turnover.

Three groups of costs affected with RRP are identified through research. Cost of investing in packaging line equipment arises at 60,9 % companies. Direct cost of packaging is increasing in 87,84 %; in more than half companies for less than 5 %. Indirect cost like transportation cost, promotional costs and shelf replenishment could also be changed by RRP implementation, but only cost of shelf replenishment time by manufacturer decreased in a large scale - for more than half of companies.

The research also provides possible explanations of reasons why food manufacturers are open to RRP implementation. Leading position among those reasons are *better shelf visibility* and *better shelf "position keeping"*, followed by *better product image*. These benefits combine direct rise of shelf visibility and creation of better relationship between brands and consumers, to help with impulse buying and brand positioning at the point of sales. Through these benefits, RRP is transforming from primary packaging into even more effective sales promotions tool. *Better relation with retailers* is benefit in negotiating positions of manufactures towards retailers. Improving negotiating position towards retailers in environment where retailers have dominant role in supply chain is an important part of trade management creating leverage for example at product listing process, in research this benefit is recognized as *easier start of cooperation with new retailers*.

Finally, from the fact that more than two third of respondents are planning to further increase the RRP share in their assortment it can be concluded that RRP has been accepted in Croatian food manufacturing as a normal business development route, as well as in other countries.

Regarding research limitations, study was conducted only in Croatian companies, and sample does not cover equally all branches of food industry. Regional survey would give a clearer view on retail ready packaging relationships in international food supply chains.

## 6. REFERENCES AND SOURCES OF INFORMATION

1. Alagiri, D. and Selvan, N. ed. (2007). *Retail Supply Chain Management : An Introduction*, Icfai Books, The Icfai University Press.
2. Arzoumanian, M. (2011). Retail Ready Packaging: Easy Does It, *Paperboard Packaging*, Vol. 96 Issue 3, p. 24-28 [available at: <http://connection.ebscohost.com/c/articles/66209887/retail-ready-packaging-easy-does-it>, access August 23, 2014]
3. Ayers, J.B. & Odegaard, M.A. (2008). *Retail Supply Chain Management*, Auerbach Publications, Taylor & Francis Group, New York, London.
4. Coles, R. (2013). *Paper and paperboard innovations and developments for the packaging of food, beverages and other fast-moving consumer goods*. in Farmer, N. (Ed.). *Trends in packaging of food, beverages and other fast-moving consumer goods (FMCG)- Markets, Materials and Technologies*. Woodhead Publishing Limited, p. 187-220.
5. Creevy, J. (2010). 10 ways Aldi changed retail, *Retail Week*, [available at: <http://www.retail-week.com/sectors/food/10-ways-aldi-changed-retail/5015950.article>, access August 21, 2014]
6. Dobrucka, R. (2013). The Future of Active and Intelligent Packaging Industry, *Logforum*, 9, (2), p. 103-110.
7. ECR Europe (2006). Shelf Ready Packaging (Retail Ready Packaging), Addressing the challenge: a comprehensive guide for a collaborative approach, [available at: <http://www.ecr-europe.org/ecr-library?view=single&id=6>, access June 24, 2014]
8. ECR Italia (2010). More shelf ready packaging in the next three years [available at: [http://ecr-all.org/blog\\_post.php?blog=ecr\\_blog&post\\_id=1574](http://ecr-all.org/blog_post.php?blog=ecr_blog&post_id=1574), access June 24, 2014]
9. Eilert, S. J. (2005). New packaging technologies for the 21st century, *Meat Science*, Vol. 71 (1), 122-127.
10. Eurostat (2013). Glossary: Statistical classification of economic activities in the European Community (NACE) [available at: [http://epp.eurostat.ec.europa.eu/statistics\\_explained/index.php/Glossary:Statistical\\_classification\\_of\\_economic\\_activities\\_in\\_the\\_European\\_Community\\_%28NACE%29](http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Statistical_classification_of_economic_activities_in_the_European_Community_%28NACE%29), access June 24, 2014]
11. Fernie, J. & Sparks, L. ed. (2009). *Logistics and retail management : emerging issues and new challenges in the retail supply chain*. 3<sup>rd</sup> Edition, Kogan page, The Chartered Institute of Logistics and Transport (UK), London and Philadelphia
12. Finne, S. & Sivonen, H. (2009). *The Retail Value Chain: How to gain Competitive advantage through Efficient Consumer Response*, Kogan Page Limited, London i Philadelphia.
13. Fisher, M. & Raman, A. (2010). *The New Science of Retailing: How Analytics Are Transforming the Supply Chain and Improving Performance*, Harvard Business Press Books

14. Food Manufacture (2006). *Reader poll: Shelf-ready dilemma for suppliers*, [available at: <http://www.foodmanufacture.co.uk/Business-News/Reader-poll>, access June 24, 2014]
15. Gustafsson, K., Jonson, G., Smith, D. and Sparks, L.: *Retailing Logistics & Fresh Food Packaging : Managing Change in the Supply Chain*, Kogan Page Limited, The Chartered Institute of Logistics and Transport, London, 2009.
16. IGD Supply Chain Analysis (2011). *Understanding Retail Ready Packaging*, presentation [available at: [http://www.aiccbbox.org/meeting/meetingan11/presentations/11\\_RetailReady\\_Overview.pdf](http://www.aiccbbox.org/meeting/meetingan11/presentations/11_RetailReady_Overview.pdf), access June 26, 2014]
17. Infiniti Research Limited (2014). *Global Retail Ready Packaging Market 2014-2018*, <https://www.reportbuyer.com/product/2051561/global-retail-ready-packaging-market-2014-2018.html> (23 June 2014)
18. Jeyamkondan, S., Jayas, D. S., Holley, R. A. (2000). Review of centralized packaging systems for distributing of retail-ready meat, *Journal of Food Protection*; Vol. 63 (6), 2000, 796–804.
19. Korzeniowski, A. (2009). Shelf Ready Packaging in Consumers' Opinion, *Logforum: Scientific Journal of logistics*, 5, (2), 1, [available at: [http://www.logforum.net/pdf/5\\_2\\_1\\_09.pdf](http://www.logforum.net/pdf/5_2_1_09.pdf), access June 26, 2014]
20. Mohan, A.M. (2012). Kraft RRP for cream cheese yields 800,000-lb paper savings, *Packaging World*[available at: <http://www.packworld.com/package-design/retail-ready/kraft-rrp-cream-cheese-yields-800000-lb-paper-savings>, access August 24, 2014]
21. Pira International (2011). *Growth in Retail-ready-Packaging Offers Significant Opportunities for Suppliers* [available at: [www.sabine-zimmermann.infohttps://www.smitherspira.com/market-reports/growth-in-retail-ready-packaging-offers-significant-opportunities-for-suppliers.aspx](http://www.sabine-zimmermann.infohttps://www.smitherspira.com/market-reports/growth-in-retail-ready-packaging-offers-significant-opportunities-for-suppliers.aspx), access August 22, 2014]
22. Pira International (2012). *Retail ready packaging market is forecast to reach \$63.4 billion by 2017*, [available at: <https://www.smitherspira.com/market-reports/retail-ready-packaging-markets-are-forecast-to-reach-63-4-billion-by-2017.aspx>, access August 22, 2014]
23. Ranade, S. S. (2008). The Indian food sector: retail-ready packaging of milk and milk products *Indian Dairyman*; Vol. 60 (3), p. 79–80.
24. Ray, R. (2010). *Supply Chain Management for Retailing*, Tata McGraw Hill Education Private Limited, New Delhi, India
25. Register of Croatian Companies (2014) [available at: <http://www1.biznet.hr/HgkWeb/do/extlogon>, access June 24, 2014]
26. Reynolds, P. (2010). A Guide to Retail-ready Packaging, *Packaging World* [available at: <http://www.packworld.com/package-design/retail-ready/guide-retail-readypackag ing>, access August 23, 2014]
27. Schrijver, M. (2013). *Retail Ready Packaging and the Importance of Design*, Essay (Master), University of Twente, Behavioral School
28. Segetlija, Z. & Dujak, D. (2013). *Upravljanje kategorijama proizvoda (category management)*, Ekonomski fakultet u Osijeku, Osijek



29. Segetlija, Z., Mesarić, J., Dujak, D. (2012). *Distinctive Features of Retail Supply Chain Management – Transportation Perspective*, The 9<sup>th</sup> International Conference on Logistics and Sustainable Transport 2012, Ipavec, Vesna Mia (Editor), University of Maribor, Faculty of Logistics, Celje, Slovenia., p. 284-292
30. Segetlija, Z., Mesarić, J., Dujak, D. (2013). Category management as a model for demand management in retailing, *Pre-Conference Proceedings of The 10th International Conference on Logistics & Sustainable Transport 2013*, Ipavec, Vesna Mia ; Kramberger, Tomaž (ed.), Celje, Slovenia : University of Maribor, Faculty of Logistics, Mariborska cesta 7, 3000 Celje, Slovenia, p. 24-32.
31. Stubbs, R. L., Morgan, J. B., Ray, F. K., Dolezal, H. G. (2002). Effect of supplemental vitamin E on the color and case-life of top loin steaks and ground chuck patties in modified atmosphere case-ready retail packaging systems. *Meat Science*; Vol. 61 (1), 1–5.
32. Venturini, A. C., Contreras, C. J. C., Sarantopoulos, C. I. G. L., Villanueva, N.D.M. (2006). The effects of residual oxygen on the storage life of retail-ready fresh beef steaks masterpackaged under a Co-2 atmosphere, *Journal of Food Science*, Volume: 71 Issue: 7, p. 560-566
33. Verghese, K., Lewis, H., Lockrey, S., Williams, H. (2013). *The role of packaging in minimising food waste in the supply chain of the future*, Final report for CHEP Australia, Centre for Design, School of Architecture and Design, RMIT University, Melbourne. RMIT University, Centre for Design, Melbourne [available at: [www.chep.com.au](http://www.chep.com.au), access August 24, 2014]
34. Walsh, H. and Kerry, J.P. (2012). Packaging of ready-to-serve and retail-ready meat, poultry and seafood products, p. 406–436 in *Advances in meat, poultry and seafood packaging*, Kerry, J.P. (Editor), Woodhead Publishing Limited
35. Warschun, M. (2011). What Traditional Retailers Can Learn From The Discounters, ATKearney, [available at: [http://www.atkearney.com/consumer-products-retail/ideas-insights/featured-article/-/asset\\_publisher/KQNW4F0xInID/content/what-traditional-retailers-can-learn-from-the-discounters/10192](http://www.atkearney.com/consumer-products-retail/ideas-insights/featured-article/-/asset_publisher/KQNW4F0xInID/content/what-traditional-retailers-can-learn-from-the-discounters/10192) , access August 23, 2014]
36. Wheeler, K. (2012). 5 environmental advantages of corrugated packaging, Norampac-Lithotech [available at: <http://lithotech.ca/5-environmental-advantages-of-corrugated-packaging/> , access June 24, 2014]



## INTERNATIONALIZATION OF RETAILING

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*Scientific paper*

### *Abstract*

Integration and globalization of world market have resulted in retail trade internationalization. In many developed countries, the retail trade is faced with the problem of limited sales growth for the sake of saturation on the domestic market, and the enter on overseas markets is seen as a sustainable growth strategy. Therefore, this study was initiated by the basic research problem: increasing growth through internationalization of business.

This paper aims to investigate and present the international activities of the European and global retailers and thus to show that the internationalization of retailing enables higher growth. During studies there are used different scientific methods: normative methods, data collection methods, content analysis, comparative, statistical, generic and other methods. Methods of data collection focused on the use of secondary data from books, magazines and websites.

The research results show that the trend of internationalization of retailing is significantly present in European retailers and sales abroad represents a significant proportion of total sales and growth. However, top retailers the majority of their sales perform on the european market. The internationalization of retailing in the US is significant, but not as intense in developed EU countries. The internationalization of retailing in Japan is evident, but less than in Europe and the United States.

Although, there is no doubt that the retail internationalization rhytm is speeded up, the majority of retailers realizes the maximum percentage of its turnover on the home market.

**Key words:** internationalization, trade, retail, globalization, market

### 1. INTRODUCTION

The trend of business globalization has actualized the topic about the international retail sale area. Certain problems in working on the home market have had such an influence on many retailers that they consider entering the foreign markets, thinking of it as a viable growth strategy. These problems include: maturity on the home market, improvement of communication technologies,

financial conditions, decrease of free trade barriers, changing the retail sale form through joining and acquisition.

„With the process of retail internationalization gaining momentum, retailing is fast to become a global industry. Indeed, the majority of distinguished world retailers already carries out its major sale part as part of international operations“ (Goldman, 2001, p. 221) .

The internalization of retail trade has speedy growth. In 1992 there were over 1.321 international institution in European Community in relation to 120 international institution in 1970 (McGoldrick & Davies, 1995, p. 22).

Internalization is present in all retail sector: foodstuff, non foodstuff, mixed and specialized trade, big and small shops, etc. However, export retail shapes are the most common shapes which stay dominant in their countries.

This paper presents the international activities of the European and global retailers aiming to show that the internationalization of retailing enables higher growth. In the first part, the study shows the international activities of European retailers through their sales abroad. This part of the study shows that the trend of internationalization of retailing is significantly present in Europe among retailers.

In the second part, the study shows the international activities of top 250 global retailers. This part of the study shows that European global retailers far more internationalized business than other world global retailers.

In the third part, the study shows the international retail alliances. This part of the study shows that international alliances are becoming a more and more present part of the retail image in the European Union.

Although, there is no doubt that the retail internationalization rhythm is speeded up, the majority of retailers realizes the maximum percentage of its turnover on the home market.

## 2. INTERNATIONAL ACTIVITIES OF EUROPEAN RETAILERS

Removing barriers for trade between national markets and forming a free European market, has provided a larger competitive environment and speeded up the growth rate. The process of retail internationalization was speeded up in Europe, especially since the late 1980s. The free European market has speeded up the retail cross-boarder expansion within the European Union (Akehurst & Alexander, 1995, p. 44).

Retail internationalization is usually found on geographic ground of North-South and West-East, in other words retail sale companies from the North part of the European Union often enter markets from the South part of the European Union, as well as companies from the West part of the European Union enter markets from the East part of the European Union. Nevertheless, in 1990 France, Great Britain and Germany represented two-thirds of international operations in Europe (Mc Goldrick & Davies, 1995, p. 23).

International activities of European retailers can be seen in Table 1.

Table 1 Europe – Top 10 Food Retailers, 2013.

Rank	Retailer	Home Country	Turnover International [Billion EUR]	Domestic Sales [Billion EUR]	Foreign Sales [%]
1.	Tesco*	UK	79.1	52.6	33.5%
2.	Carrefour	France	74.9	35.4	52.7%
3.	Schwarz	Germany	74.0	30.9	58.2%
4.	Metro	Germany	67.3e	25.6	62.0%
5.	Aldi	Germany	64.7	25.5	60.6%
6.	Rewe	Germany	50.6	36.2	28.5%
7.	Auchan	France	48.1	20.6	57.2%
8.	Edeka	Germany	46.2	46.2	0.0%
9.	E. leclerc	France	36.5	33.9	7.1%
10.	Sainsbury's	UK	28.3	27.9	1.4%
	<b>Top 10</b>		<b>569.7</b>	<b>334.8</b>	<b>41.2%</b>

\* Fiscal year 2013.

e = estimate

Source: Author's construction, Data: Top Food Retailers in Europe, [available at: <http://retail-index.com/Sectors/FoodRetailersinEuropeandworldwide.aspx> access June 04, 2014, and Top 25 retailers in Europe, [available at: <http://www.retail-index.com/HomeSearch/TopretailersinEuropebycountry.aspx> access June 04, 2014].

From the previous table it is visible significantly high turnover at leading food retailers. However, it is interesting that the big part of the turnover (41.2%), the leading food retailers realized on foreign market. Of total 10, five of them have bigger turnover with foreign countries, than in domestic market. However, top retailers the majority of their sales perform on the european market, which illustrates the table 2.

Table 2 Top 10 Food Retailers in Europe, 2012.

Rank by Turnover in Europe	Retailer	Home Country	Turnover International Billion EUR	Turnover in Europe Billion EUR	% Retail Sales Outside Europe
1.	Schwarz	Germany	69.5	69.5	0.0%
2.	Tesco*	UK	89.2	65.2	26.9%
3.	Carrefour	France	76.8	56.2	26.8%
4.	Aldi	Germany	66e	55e	16.7%
5.	Rewe	Germany	49.7	49.7	0.0%
6.	Metro	Germany	66.7	45.4	31.9%
7.	Edeka	Germany	45	45	0.0%
8.	E. leclerc	France	47	44	6.4%
9.	Auchan	France	44	41	6.8%
10.	ITM	France	34	34	0.0%

\* Fiscal year 2013.

Source: Author's construction, Data: Top Food Retailers in Europe, [available at: [available at: [www.retail-index.com](http://www.retail-index.com), access November 24, 2013].

Analysis of the previous table shows that the leading European retailers most of their sales carry out at the European market. Of the ten leading retailers in Europe, six of them in addition to the European market also sale on the global market, while the remaining four retailers are selling exclusively to the European market. These data led to the notion that the internationalization of retail is intensified in the area of a single economic space of the European Union, which is a result of a single business regulation at the level of the EU. Also, a large number of European retailers is located within the top 250 global retailers.

Retailers from Western Europe have a leading position on the market in Central and Eastern Europe, which can be seen from the following table:

Table 3 Central and Eastern Europe: Top 20 Grocery Retailers, 2011.

Rank	Company	Country	Number of outlets	Banner sales [Million EUR]	Food retail format sales [Million EUR]
1.	Metro Group	Germany	464	17,745	3,068
2.	Schwarz Group	Germany	1,958	14,016	14,016
3.	X5 Retail Group	Russia	3,011	12,774	12,768
4.	Auchan	France	193	9,478	9,478
5.	Magnit	Russia	5,309	9,458	9,433
6.	Tesco	UK	1,066	8,919	8,702
7.	Jeronimo Martins	Portugal	1,916	6,259	6,241
8.	Carrefour	France	1,311	6,108	6,108
9.	Rewe Group	Germany	1,353	5,238	5,200
10.	COOP EURO	CE	10,883	4,307	4,307

Source: Planet Retail Ltd - Top 20 CEE Grocery Retailers, [available at: [http://www.google.ba/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0CDkQFjAC&url=http%3A%2F%2Fwww1.planetretail.net%2Fsites%2Fdefault%2Ffiles%2Fpdfs%2FPlanetRetailDailyNews-78704.pdf&ei=4sKUU\\_CAKcXjO\\_n6gZAB&usg=AFQjCNFWN9MW6NVklvnOwWG7yncDXWJdmQ](http://www.google.ba/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&ved=0CDkQFjAC&url=http%3A%2F%2Fwww1.planetretail.net%2Fsites%2Fdefault%2Ffiles%2Fpdfs%2FPlanetRetailDailyNews-78704.pdf&ei=4sKUU_CAKcXjO_n6gZAB&usg=AFQjCNFWN9MW6NVklvnOwWG7yncDXWJdmQ) access June 08, 2014.].

Previous table shows that of the Top 20 Grocery Retailers in the Central and Eastern Europe, 10 of them are from Western Europe. From the Top 10 Grocery Retailers in the Central and Eastern Europe, 7 of them are from Western Europe (3 of them are from Germany). Thus, the Western European retailers are leading retailers on the market in the Central and Eastern Europe.

### 3. INTERNATIONAL ACTIVITIES OF GLOBAL RETAILERS

The leading World international retailers in 2011, according to the turnover total and the number of countries they do business in, can be seen in the following table:

Table 4 Top 10 retailers worldwide, 2011.

Top 250 rank	Name of retailer	Country of origin	Retail revenue Million USD	Retail revenue growth	Number countries of operation	% Retail revenue from foreign operations
1.	Wal-mart	US	446,950	6.0%	28	28.4%
2.	Carrefour	France	113,197	- 9.8%	33	56.7%
3.	Tesco	UK	101,574	5.8%	13	34.5%
4.	Metro	Germany	92,905	- 0.8%	33	61.1%
5.	Kroger	US	90,374	10.0%	1	0.0%
6.	Costco	US	88,915	14.1%	9	27.0%
7.	Schwarz	Germany	87,841	5.8%	26	55.8%
8.	Aldi	Germany	73,375	3.7%	17	57.1%
9.	Walgreen	US	72,184	7.1%	2	1.5%
10.	The Home Depot	US	70,395	3.5%	5	11.4%
	Top 10		1,231,710	4.4%	16.7	32.9%
	Top 250		4,271,171	5.1%	9.0	23.8%
	Top 10 share of Top 250		29.0%			

Source: Global Powers of Retailing, [available at: <http://www.stores.org/global-powers-retailing-top-250-highlights-1>, access January 04, 2014.].

From the previous table we can see that only four of the top 10 retailers worldwide achieve a greater turnover abroad than in the domestic market. It also shows that European retailers have a higher degree of internationalization than U.S. retailers. European leading retailers have a higher percentage of sales abroad and operate in a larger number of countries, than the American retailers. On average, the Top 10 retailers operated in 16.7 countries in 2011. In total, 32.9% of sales came from outside retailers' home countries. Within the top 10 retailers worldwide, five retailers are from Europe (three German, one French and one British retailer).

Aggregate retail revenue of Top 250 amounted to 4.27 trillion USD in 2011. Percent of Top 250 retail revenue from foreign operations amounted to 23.8%. Average number of countries in which Top 250 companies have retail operations was 9. Top 250 Global retailers by Region, can be seen in the following table:

Table 5 Top 250 Global retailers by Region, 2011.

Region	Number companies	Retail revenue Million USD	Number countries of operation	% Retail revenue from foreign operations
Europe	88	1,644,280	15.0	38.2
North America	86	1,849,344	6.2	15.3
Latin America	11	93,698	2.0	17.8
Asia/Pacific	58	638,522	5.0	11.6
Africa	7	45,318	10.3	26.9
Top 250	250	4,271,250	9.0	38.0
SAD	76	1,726,188	6.8	15.3
Japan	40	384,320	3.4	6.6

Germany	18	449,586	14.6	42.9
UK	15	274,800	17.1	23.0
France	13	397,215	30.0	43.2

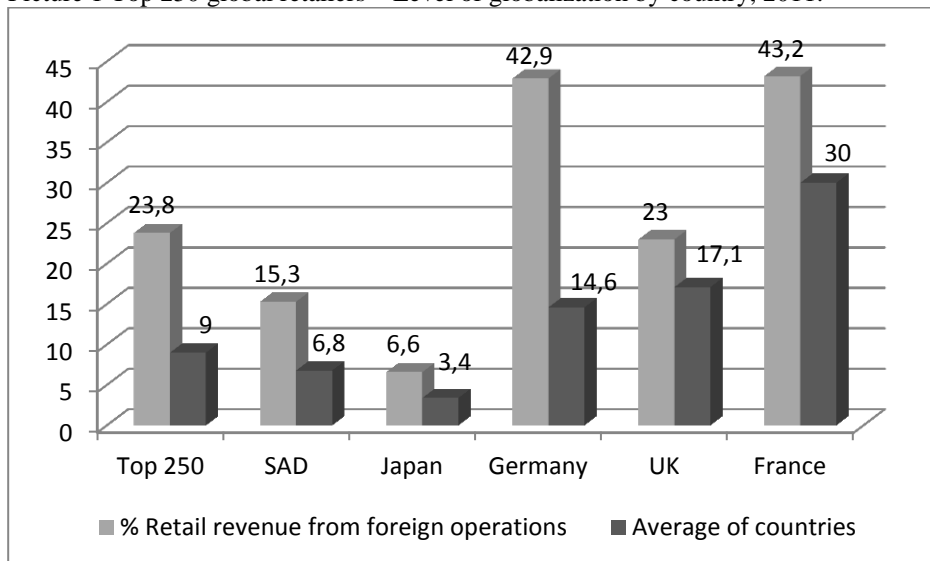
Source: Global Powers of Retailing, [available at:

<http://www.stores.org/STORES%20Magazine%20January%202013/global-powers-retailing-geographical-analysis?page=2>, access January 07, 2014.].

Previous table shows that in Europe and the United States concentrated two-thirds of the 250 world's leading retailers, who earn four-fifths (79%) of the total turnover of the top 250 global retailers.

Comparison of the internationalization of global retailers from leading countries illustrates the following picture:

Picture 1 Top 250 global retailers – Level of globalization by country, 2011.



Source: Autor's constructions, Data: Global Powers of Retailing Top 250, [available at:

<http://www.stores.org/STORES%20Magazine%20January%202013/global-powers-retailing-geographical-analysis?page=2>, access January 07, 2014.].

Previous image shows that retailers from three leading European countries have a much higher degree of internationalization than retailers from the U.S. and Japan.

#### 4. INTERNATIONAL RETAIL ALLIANCES

Intensive processes of retail internationalization have brought about a horizontal collaboration and joining of retail from different countries in Europe, which resulted in the establishing of international retail alliances. International retail alliances are a fairly new phenomenon, but regardless of that they exist in many



forms. The Institute of Grocery Distribution 1992 identified four types of alliances which have developed over recent years:

- Alliances established on development grounds, as an agreement between retailers on cooperation in specific projects, in many ways as a way of entering the national market;
- Buying groups, where the members collaborate in buying, which increases their influence on the producer;
- Alliances established on knowledge and skills, where retailers engage in cognition and technical sense with others; and
- Multi-functional groups, which combine the elements of the previous three types of alliances and where individual members can increase strategic advantages by engaging in expertises, such as information technologies and systems (Akehurst & Alexander, 1995, p. 47).

Advantages gained by many members of international alliances are numerous, such as: a joint voice in trade politics, increase of buying power by economy of scale, brand/development, introducing and transfer for paneuropean retail brands, technology knowledge and systems, knowledge improvement, market entry protection, a great readiness of international growth and geographic market expansion, competitive position improvement and so on.

International alliances are becoming a more and more present part of the retail image in the European Union. International alliances are a dominating part of the European food retail, realizing over 300 billion euros from the total turnover including over 130.000 retail facilities in all nations of the European Union (McGoldrick & Davies, 1995, p. 135).

According to the evaluations made public by EMD, the leading retail alliance in Europe, the top 15 retailers and retail alliances in Western and Central Europe have a combined share of 77% of the sales value (Sales value 803.6 billion EUR in 2002.).<sup>12</sup>

European Marketing Distribution (EMD) is the leading European retail alliance of independent retailers. The alliance of 15 members, bundling 500 players in the grocery retail sector in 16 countries, covers 150.000 points of sales, cumulating a potential consumer turnover of 140 billion Euro. The cooperation between the members of EMD and their affiliated retail organisations creates attractive and competitive conditions for the independent European grocery retailers.<sup>13</sup>

## 5. CONCLUSION

World market integration and globalization resulted in trade

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<sup>12</sup>Carmen Balan: The Alliances of European Retailers and Their Effects in the Field of Marketing and Supply Chain, [available at: <http://www.rejournal.eu/Portals/0/Arhiva/JE%2025%20bis/JE%2025%20-%20Balan.pdf>], access January 13, 2014.].

<sup>13</sup> European Marketing Distribution (EMD), [available at: <http://www.emd-ag.com/>], access January 14, 2014.].

internationalization, especially of its retail sector. Removing barriers for trade between national markets and forming a free European market, has provided a larger competitive environment and speeded up the growth rate. The free European market has speeded up the retail cross-boarder expansion within the European Union.

The trend of internationalization of retailing is significantly present in European retailers. However, retailers the majority of their sales perform on the European market. These data led to the notion that the internationalization of retail is intensified in the area of a single economic space of the European Union, which is a result of a single business regulation at the level of the EU.

In the Europe and in the United States concentrated two-thirds of the 250 world's leading retailers, resulting in a four-fifths (79%) of total turnover of the top 250 global retailers. Percent of Top 250 retail revenue from foreign operations amounted to 23.8%. Average number of countries in which Top 250 companies have retail operations was 9. From the previous analyzes can be seen that only four of the top 10 retailers worldwide achieve a greater turnover abroad than in the domestic market. It also shows that European retailers have a higher degree of internationalization than US and Japanese retailers. European leading retailers have a higher percentage of sales abroad and operate in a larger number of countries, than the American and Japanese retailers.

Intensive processes of retail internationalization have brought about a horizontal collaboration and joining of retail from different countries in Europe, which resulted in the establishing of international retail alliances. European Marketing Distribution (EMD) is the leading European retail alliance of independent retailers. The alliance of 15 members, bundling 500 players in the grocery retail sector in 16 countries, covers 150.000 points of sales, cumulating a potential consumer turnover of 140 billion Euro. The cooperation between the members of EMD and their affiliated retail organisations creates attractive and competitive conditions for the independent European grocery retailers.

In the end, this paper has shown that the leading European and world retailers generate a significant part of sales abroad and internationalization of retailing enables higher growth.

## 6. REFERENCES

1. Akehurst, G. & Nicholas, A. (1995). *The Internationalization of Retailing*, Francis and Taylor, London.
2. Balan, C.: The Alliances of European Retailers and Their Effects in the Field of Marketing and Supply Chain, [available at: <http://www.rejournal.eu/Portals/0/Arhiva/JE%2025%20bis/JE%2025%20-%20Balan.pdf>], access January 13, 2014.].
3. European Marketing Distribution (EMD), [available at: <http://www.emd-ag.com/>], access January 14, 2014.].
4. Global Powers of Retailing, [available at: <http://www.stores.org/global-powers-retailing-top-250-highlights-1>], access January 04, 2014.].

5. Global Powers of Retailing, [available at: <http://www.stores.org/STORES%20Magazine%20January%202013/global-powers-retailing-geographical-analysis?page=2>, access January 07, 2014.].
6. Goldman Ariele. (2001). The Transfer of Retail Formats Into Developing Economies, *Journal of Retailing*, Vol. 77, Issue 2, p. 221-222.
7. Ishak, M. (2014). *Internationalization of the Retail Trade*, LAP LAMBERT Academic Publishing, Saarbrücken, Deutschland/Germany.
8. McGoldrick & Davies, G. (1995). *International Retailing: Trends and Strategies*, Financial Times, London.
9. Top 25 retailers in Europe, [available at: <http://www.retail-index.com/HomeSearch/TopretailersinEuropebycountry.aspx>, access June 04.2014.].
10. Top Food Retailers in Europe, [available at: <http://retail-index.com/Sectors/FoodRetailersinEuropeandworldwide.aspx> access June 24.2014.].
11. Top Food Retailers in Europe, [available at: [www.retail-index.com](http://www.retail-index.com) access November 24.2013.].



## **LOGISTIC DISTRIBUTION CENTRES – BUSINESS SUCCESS FACTOR OF TRADING COMPANIES**

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*Scientific paper*

### ***Abstract***

In order to impact national, regional and global markets trading companies should establish logistic distribution centres. Their number, size, equipment, location, traffic and infrastructure connectivity, economic growth and the rise of consumer power on national, regional and global markets affects the development of logistic network and exploitation of trading company synergies. Special attention should be paid to positioning of logistic distribution centres, because market coverage depends on their strategic planning, and by that, the possibility of optimizing the logistic network and rapid response to consumer demands. To prove the hypothesis about logistic distribution centres as a decisive factor of business success of trading companies, methods of analysis and synthesis were applied, as were the mathematical and comparative method. The findings are based on analysis of a hypothetical example of optimizing the logistic network of a trading company by establishing a logistic distribution centre, but also on the analysis of several practical examples of establishing (national) logistic distribution centres of trading companies in Croatia. A particular object of research is the establishment of Lidl's logistic distribution centre in Perušić.

**Key words:** trading companies, logistic distribution centres, logistic network

### **1. INTRODUCTION**

Modern logistics distribution centres went through an intense development phase between 1970 and 1980 when entrepreneurship began to flourish and larger properties for production were being sought. These were equipped with adequate infrastructure and transport connections, but also ensured tax, fiscal and employment benefits. The first modern distribution centre was opened in 1970 by Walmart, the world's largest retailer, at its headquarters in Bentonville, Arkansas.

Its purpose was reduction of logistic expenses and increase in efficiency of inventory management (Nadilo, 2012). All logistics distribution centres depend on good transport connections. The low cost of land is also important, as are good infrastructural facilities, and they are commonly found in business and economic zones. Their number, size and positioning on the logistic network of a trading company dictates the possibility of optimizing logistics costs and thus the success of the trading company.

Recently, trading companies are facing a dilemma of opening their own logistics distribution centres or renting a space in centres appropriately equipped and positioned in the most favourable positions. For example, the main feature of Immopark Zagreb (the new logistics distribution centre in Jastrebarsko) is its proximity to the A1 motorway exit for Jastrebarsko, its distance of only 24 km from Zagreb, and the availability of the entire motorway network through the nearby junction Lučko. There are plans for railway expansion, since the railway line is also in vicinity of the centre. Other Croatian cities are also easily accessed from this point (Rijeka – 125 km, Osijek – 280 km, Split – 336 km), as well as other major cities in the region (Ljubljana – 137 km, Vienna – 380 km, Budapest – 380 km, Sarajevo – 410 km, Belgrade – 415 km). Therefore, it is not surprising that Lidl's logistics centre was built along the access road to Jastrebarsko in 2008 and will be discussed in this research. Apart from Lidl, the leader in central distribution in Croatia is Konzum, which operates with two of its own logistics distribution centres in Zagreb and Dugopolje (Dujak, et al. 2011).

## 2. THEORETICAL FRAMEWORK

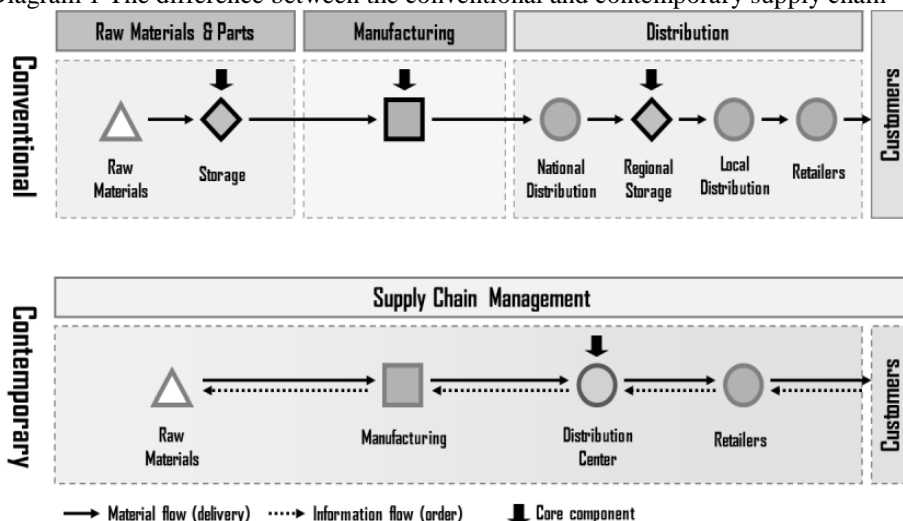
Logistics distribution centres have evolved from traditional warehouses. The main difference between distribution centres and warehouses is the fact that a warehouse is designed to store goods for longer periods of time. Distribution centers are facilities with primary purpose of logistic coordination. There is a number of different activities within a centre, with the main task of constant adapting to new market demands through continuous automation and computerization. Besides manipulative activities (loading, unloading, load transfer), there is a development in trade, delivery and transport functions in logistic systems on all levels. New modes of production are concomitant with new modes of distribution. Their main purpose is to provide value-added services to freight, which is stored for relatively short periods of time (days or weeks). DCs are often in proximity to major transport routes or terminals.

The scope and significance of logistics distribution systems is continually amplifying. The continuous growth of the number and contents of logistic activities

conditions the growth of the relative share of logistic costs in total costs structure. Thus, in terms of globalization, the challenge of finding the way to minimize logistic costs is put before economic science even more ardently. Namely, the basic factor of global efficiency is a design of an adequate spatial configuration, and building efficient business infrastructure and network of external connections required for the implementation of business strategies. Internationalization of business leads to centralization of distribution, and distribution centers are a market example of such centralization. Of course, we are talking about large regional centres.

The fundamental difference between the conventional and contemporary approach to distribution management in supply chains is reflected exactly in the approach to distribution (cf. Diagram 1).

Diagram 1 The difference between the conventional and contemporary supply chain



Source: Hesse, M. & Rodrigue, J.P. (2004) "The Transport Geography of Logistics and Freight Distribution", *Journal of Transport Geography*, Vol. 12, No. 3, pp. 171-184.

Hesse and Rodrigue (2004) emphasize that contemporary supply chain freight flows tend to be of lower volumes, of higher frequency, often taking place over longer distances (outsourcing and offshoring). These flows have been associated with a modal adaptation, namely through containerization. The extent of these changes can be characterized by the growth of geographical areas of interaction, and by the temporal flexibility of freight flows, both resulting in a rising amount of freight transport. The distribution center thus becomes the core component of such a distribution system as it regulates the flows of a closer interaction between production and consumption.

Accordingly, it is highly likely that some trading companies will try to consolidate certain markets of a region or its parts by providing services from a single logistics distribution centre. In the long run, such decisions will depend primarily on the further development of economy, production, consumption and

distribution. By establishing a logistics distribution centre, a full control of product entry and exit is achieved, as well as significant time savings, while errors are minimized and unused storage space is a rare occurrence. The main motif is a more efficient and cheaper goods distribution, and ultimately, an increase in profit. The development of transport infrastructure reduces the need for smaller warehouses in every large regional centre, so a number of retail companies more and more opt for a central warehouse and logistics distribution centre. Thereby, costs are drastically reduced. Basic features of logistics distribution centres are given in Table 1.

Table 1 Characteristics of large-scale distribution centers

<b>Size</b>	Larger	More throughput and less warehousing.
<b>Facility</b>	One storey; Separate loading and unloading bays	Sorting efficiency.
<b>Land</b>	Large lot	Parking space for trucks (often not necessary due to high throughput); Space for expansion.
<b>Accessibility</b>	Proximity to highways	Constant movements (pick-up and deliveries) in small batches (often LTL); Access to corridors and markets.
<b>Market</b>	Regional / National	Less than 48 hours service window.
<b>IT</b>	Integration	Sort parcels; Control movements from receiving docks to shipping dock; Management systems controlling transactions.

Source: <http://people.hofstra.edu> [access June 12, 2014]

### 3. RESEARCH RESULTS

Each possible logistics system implies a total logistics cost given by the expression (Kotler, 1988, p. 579):

$$M = T + FW + VW + S \quad (1)$$

Where:

M = total logistics cost of proposed system

T = total freight cost of proposed system

FW = total fixed warehouse cost of proposed system

VW = total variable warehouse cost (including inventory) of proposed system

S = total cost of lost sales due to average delivery delay under proposed system



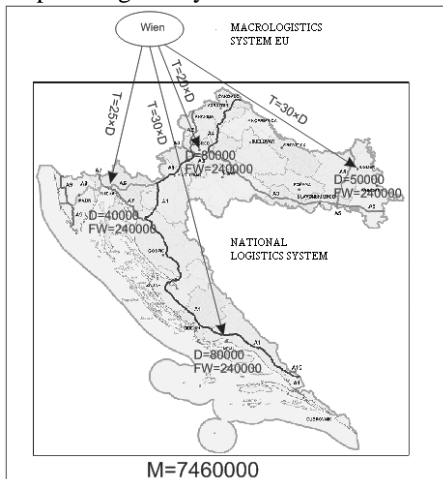
We will now examine the total distribution cost associated with different proposed distribution systems (with or without LDC) and select the system that minimizes total distribution cost.

In the example under consideration the emphasis is on total freight cost of proposed system and total fixed warehouse cost of proposed system.

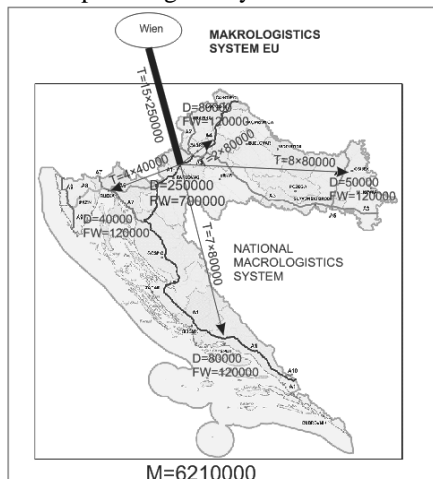
To clearly demonstrate the possibility of optimizing the supply chain in the logistic system by establishing a logistics distribution centre, a hypothetical example is considered below. A distributor of home appliances is considering establishing a logistic system of logistic market in Croatia. They made an estimation of annual demand of 250 000 products. They are considering the possibility of selling in leased retail premises in Split (demand of 80 000 products), Zagreb (80 000), Rijeka (40 000) and Osijek (50 000). Costs of each retail and warehouse facilities amounts to 20 000 HRK per month. Retail facilities could be supplied from Vienna at these transportation costs: Vienna – Zagreb 20 HRK per unit, Vienna – Rijeka 25 HRK per unit, Vienna – Osijek 30 HRK per unit, and Vienna – Split 30 HRK per unit. They are considering the possibility of opening a regional warehouse in Croatia, in the Zagreb area, more precisely in Jastrebarsko. Annual cost of renting a warehouse in Jastrebarsko amounts to 700 000 HRK. In that case, aggregate shipment cost from Vienna to Zagreb would be 15 HRK per product. Shipment from Jastrebarsko to sales premises in Zagreb would be 2 HRK, to Rijeka 4 HRK, to Split 7 HRK and to Osijek 8 HRK. Opening of LDC in Jastrebarsko would lessen the need for storage in these cities, so monthly storage costs would be 10 000 HRK lower.

Map 1a and 1b show a single-level logistic system (without a LDC) and a multi-level logistic system (with a LDC) and total costs of both systems.

Map 1a Logistic system without LDC.



Map 1b Logistic system with LDC.



Source: authors

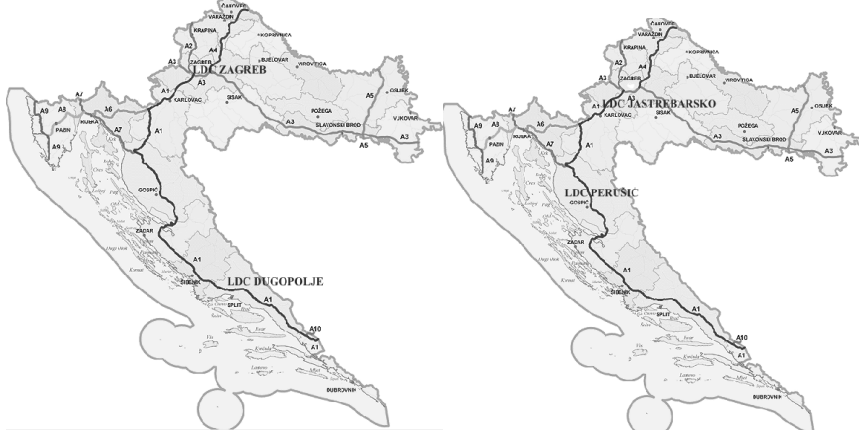
Comparison of Map 1a and Map 1b shows lesser total costs in a logistic system with a LDC, in the amount of 1,25 million HRK, or 16,7%.

Freight distribution is a **market servicing activity**, implying that the nature and structure of the market will have an important impact on the manner it is serviced. Freight distribution is deeply imbedded within its regional geography. Two related variables can help define the level of service performed by a distribution network composed of a set of distribution centers, each covering a specific portion of the territory. The first is the **average distance to customers**, which defines the market size as well as the delivery and return (back haul) distance. The second is the **lead time** which is the time it takes for a distribution center to deliver the goods once an order has been placed.

Accordingly, the following shows Konzum's and Lidl's distribution systems in Croatia, respectively, based on the selection of two of their logistics distribution centres.

Map 2a. Konzum's central distribution.

Map 2b. Lidl's central distribution.



Source: Authors

These two maps represent two different but similar optimal scenarios in distribution centres choice of location in Croatia. It is based on two basic assumptions. The first is that the market potential is directly related to the accessible population. The second is that deliveries are done by truck using the motorway network. For two distribution centers, the optimal locations would be one for the south and one for the north of the country. The main variables for choosing a location of a LDC are: 1) total population within their respective market areas, 2) lead time and 3) average distance to customers. Frequency of service is an important variable that influences the suitable number of distribution centers servicing a supply chain. A low frequency level tends to require less distribution centers than a high frequency level. A limited number of distribution centers also implies longer distances for empty returns, which is costly.

Interestingly, Konzum supplies warehouses in Osijek, Rijeka and Poreč from LDC Zagreb, while Zadar, Korčula and Dubrovnik are supplied from LDC Dugopolje. Lidl has chosen a different approach. Namely, their LDC Jastrebarsko supplies the region of Zagreb and Slavonia, while LDC Perušić supplies Istria,

Kvarner, Lika, Gorski kotar and Dalmatia. While many predicted Lidl's failure on Croatian market, up to 2011 they have invested more than 3 billion HRK in retail network, and 180 million HRK in construction of LDC Perušić.

Basic information on Lidl's LDCs are given in Table 2.

Table 2 Basic features of Lidl's supply centres, LDC Jastrebarsko and LDC Perušić.

Basic information	LDC Jastrebarsko	LDC Perušić
Surface area (m <sup>2</sup> )	45000	31200
Number of employees	90	85
Monthly average of input pallets	23000	20239
Monthly average of comissioned cartons	1680000	1593485
Monthly average of output pallets	27000	23599
Daily average of delivery trucks	23	23
Number of supplied retail premises	49	35
Number of forklifts	70	40
Number of articles (standard range)	na	1600
Warehouse capacity (euro pallet)	22000	13000
Number of supply branch offices	49	35
Supply region	Zagreb, Slavonia	Istria, Kvarner, Lika, Gorski kotar, Dalmatia
Average distance from branch offices to warehouses (km)	140	191

Source: Authors, according to Lidl's internal data

#### 4. CONCLUSION

Logistics distribution centres have evovled from traditional warehouses. Modern logistics distribution centres went through an intense development phase between 1970 and 1980. The main difference between distribution centres and warehouses is the fact that a warehouse is designed to store goods for longer periods of time. Distribution centers are facilities with primary purpose of logistic coordination. In practice of large trading companies on croatian market becomes obvious that to optimal cover the croatian retail network needed two logistics-distribution centers. It is based on two basic assumptions. The first is that the market potential is directly related to the accessible population. The second is that deliveries are done by truck using the highway network. For two distribution centers, the optimal locations would be one in north Croatia (Jastrebarsko) and one in south Croatia (Perušić in our opinion).

## 5. REFERENCES

1. Dujak, D., Tomašević V., Šantorić I. (2011). Implementacija RFID tehnologije u logističke i supply chain aktivnosti maloprodaje, u Poslovna logistika u suvremenom menadžmentu, Ekonomski fakultet u Osijeku, Osijek, 259-277.
2. Hesse, M. & Rodrigue, J.P. (2004). "The Transport Geography of Logistics and Freight Distribution", Journal of Transport Geography, Vol. 12, No. 3, pp. 171-184.
3. Kotler, Ph. (1988). Marketing Management, Prentice-Hall International Editions, New Jersey.
4. Nadilo, B. (2012). Logističko distribucijski centar u Jastrebarskom, Građevinar, 1/2012., 47-52.
5. <http://people.hofstra.edu> [access June 12, 2014]

## MODERN DEVELOPMENTS IN DISTRIBUTIVE TRADE

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### **Abstract**

Distributive trade represents a significant economic activity within national economy that links and mediates between production and consumption. Its importance is commonly indicated by its contribution to the national GDP and labour force employment. Institutionally, distributive trade is conducted by distributive trade enterprises that act as intermediaries and facilitators of exchange process between producers and consumers in a channel of distribution. By carrying out their specific channel functions, distributive trade enterprises contribute to the fulfilment of the main purpose of distribution channel as well as of value network as a whole – to efficiently satisfy consumers' needs by adding value through provision of time, place, possession and form utility. In this way, distributive trade directly interferes and influences people's standard of living and quality of life.

The purpose of the paper is to present research results on developments in distributive trade in Croatia and to compare them with those of developed European market economies.

**Key words:** distributive trade, developments, channel of distribution

### **1. INTRODUCTION**

The relevance of distributive trade within economies is usually measured by its participation in GDP and the number of persons employed. Other indicators such as a number of enterprises engaged in distributive trade, their turnover and value added are used as well to determine the significance of distributive trade and degree of its development.

The paper acknowledges these findings and uses them to point out modern developments in distributive trade. Data on each aforementioned indicator have been collected and processed for the three best performing economic activities in Croatia as well as within the economies of the 27 member states of the European Union (hereinafter EU 27). Findings are presented in the form of tables comparable by the methodology, reference period, economic activity, employment size classes of enterprises and territory. Data presented in the first two subdivisions of the paper

have been collected and processed from the national accounts statistics, while the latter ones have been sourced from the structural business statistics.

## 2. THE MAIN INDICATORS OF SIGNIFICANCE AND MODERN DEVELOPMENTS IN DISTRIBUTIVE TRADE

### 2.1. Gross value added and gross domestic product

Table 1. points to three the most significant economic activities in Croatia by gross value added in the GDP structure during the period 2004 – 2010. The proportion of distributive trade accounts for 10,4% on average that ranks it as the second most important economic activity just after Manufacturing. Unlike developments in other observed economic activities marked by the multiannual increase of the gross value added in the GDP structure (Real estate activities) or its decrease (Manufacturing), the main feature of developments in distributive trade can be described as volatile due to periods of the value rise, stability and, finally, decline.

Table 1 Gross value added according to NKD2007<sup>14</sup> and gross domestic product, structure, at current prices

	GDP structure, %						
	2004	2005	2006	2007	2008	2009	2010
<b>Manufacturing</b>	15,1	14,5	14,0	14,1	13,5	13,3	13,6
<b>Wholesale and retail trade; repair of motor vehicles and motorcycles</b>	10,5	10,7	11,0	10,7	10,7	9,5	9,4
<b>Real estate activities</b>	7,6	7,6	7,9	8,8	8,5	9,0	9,1

Source: Statistical Yearbook of the Republic of Croatia 2013, p. 205; Statistical Yearbook of the Republic of Croatia 2012 p. 201

At the EU 27 level as well, distributive trade is the second most important contributor of gross value added in GDP structure, just after Manufacturing, as accounted for 10,2% on average during the reference period (Table 2.). As it can be seen from the Table, developments in Manufacturing and Real estate activities corresponds to those in Croatia, while in distributive trade they show a tendency of decline.

<sup>14</sup>NKD 2007. - Nacionalna klasifikacija djelatnosti, verzija 2007. (hr.) - National Classification of Activities, 2007 version. NKD 2007 is based on and comparable to the Statistical classification of economic activities in the European Community, NACE Rev. 2. An alphabetical codes used in the paper to identify economic activities classified into sections according to NACE Rev.2 / NKD 2007. are as follows: C Manufacturing; F Construction; G Wholesale and retail trade; repair of motor vehicles and motorcycles; M Professional, scientific and technical activities.

Table 2 Gross value added (at basic prices) according to NACE Rev.2 and gross domestic product at market prices, structure

	<b>GDP structure, %</b>						
	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
<b>Manufacturing</b>	15,0	14,7	14,6	14,6	14,2	13,0	13,6
<b>Wholesale and retail trade; repair of motor vehicles and motorcycles</b>	10,4	10,3	10,1	10,1	10,2	10,1	9,9
<b>Real estate activities</b>	9,0	9,1	9,1	9,3	9,4	9,5	9,5

Source: author's calculation based on EUROSTAT data [online data codes: nama\_gdp\_c, nama\_nace10\_c and nama\_nace21, access: 17.06.2014.]

Notes: Figures are rounded to one decimal place.

## 2.2. Number of persons employed

As a source of employment, distributive trade in Croatia averaged for 13,8% of persons employed during the period 2008 – 2012 that sets it as the third most relevant employer, after Manufacturing and Agriculture, forestry and fishing (Table 3). Presented data show a decline in employment in distributive trade as well as in Manufacturing.

Table 3 Distribution of persons in employment, according to NKD 2007

	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
<b>Agriculture, forestry and fishing</b>	13,4	13,9	14,9	15,4	13,7
<b>Manufacturing</b>	18,6	17,2	16,4	16,9	17,4
<b>Wholesale and retail trade; repair of motor vehicles and motorcycles</b>	14,7	14,3	13,2	13,2	13,5

Source: Statistical Yearbook of the Republic of Croatia 2013, p. 159; Statistical Yearbook of the Republic of Croatia 2011, p. 154; Statistical Yearbook of the Republic of Croatia 2010, p. 154

During the period 2008 – 2012 distributive trade employed 14,1% on average at the EU 27 level (Table 4.) Such proportion in total employment makes distributive trade the second largest employer, just after Manufacturing. The same developments present in Croatia can be noticed at the EU 27 level, too – a share in employment in distributive trade, as well as in Manufacturing, declines.

Table 4 Distribution of employment by economic activity according to NACE Rev.2

	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
<b>Manufacturing</b>	17,3	16,3	15,9	15,9	15,8
<b>Wholesale and retail trade; repair of motor vehicles and motorcycles</b>	14,2	14,2	14,1	14,0	14,0
<b>Human health and social work activities</b>	9,6	10,0	10,3	10,5	10,6

Source: author's calculation based on EUROSTAT data [online data code: lfsa\_egan2, access: 17.06.2014.]

Note: As in Table2.

### 2.3. Number of enterprises within structural business statistics

More detailed data on the significance of distributive trade and its developments can be found within structural business statistics<sup>15</sup> where data on the performance of enterprises broken down by their size classes (measured in terms of the number of persons employed) have been collected and processed by Croatian official statistics since 2008.

In regard to that, Table 5. distinguishes three best performing economic activities by total of active business entities during the period 2008 – 2011 in Croatia. As it is evident from the Table, in spite of the downsize in the total number of enterprises, interrupted by the sudden rise in 2009, distributive trade continues to hold a leading position as it engages in more than 40 000 legal entities and natural persons. Similarly as in the structure of other economic activities, micro enterprises<sup>16</sup> dominate in distributive trade as account for more than 92,3% on average. Due to proportion of large enterprises that remains stable over the observed period, the share of small and medium-sized enterprises (hereinafter SMEs) in total number of enterprises in distributive trade stays constant at 99,8%.

Table 5 Number of enterprises, by size classes of number of persons employed, according to NKD 2007

Year	Economic activity	Total number of enterprises	Structure, %	Enterprise size classes
2008	C	24 071	84,0	0 – 9
			15,2	10 – 249
			0,8	250 +
	F	24 824	89,2	0 – 9
			10,7	10 – 249
			0,2	250 +
	G	46 817	91,4	0 – 9
			8,4	10 – 249
			0,2	250 +
2009	C	25 351	85,2	0 – 9
			14,1	10 – 249
			0,7	250 +
	F	27 083	90,5	0 – 9
			9,4	10 – 249
			0,2	250 +
	G	49 330	92,5	0 – 9

<sup>15</sup> Structural business statistics or non- financial business economy refer to economic activities classified by NACE Rev.2 into following sections: B (Mining and quarrying), C (Manufacturing), D (Electricity, gas, steam and air conditioning supply), E (Water supply; sewerage, waste management and remediation activities), F (Construction), G (Wholesale and retail trade; repair of motor vehicles and motorcycles), H (Transportation and storage), I (Accommodation and food service activities), J (Information and communication), L (Real estate activities), M (Professional, scientific and technical activities), N (Administrative and support service activities) and division 95 of section S (Repair of computers and personal and household goods).

<sup>16</sup> Enterprise sizes by the number of persons employed are as follows: micro enterprises < 10 persons employed, small enterprises between 10 and 49 persons employed, medium – sized enterprises between 50 and 249 persons employed, large enterprises ≥ 250 persons employed, small and medium-sized enterprises < 250 persons employed. In the paper, due to tables' limits, data on small enterprises (10-49 persons employed) and medium-sized enterprises (50-249 persons employed) are aggregated (10-249).



			7,3	10 – 249
			0,2	250 +
<b>2010</b>	<b>C</b>	23 809	84,7	0 – 9
			14,5	10 – 249
			0,7	250 +
	<b>F</b>	24 671	91,6	0 – 9
			8,3	10 – 249
			0,2	250 +
	<b>G</b>	45 624	92,8	0 – 9
			7,0	10 – 249
			0,2	250 +
<b>2011</b>	<b>C</b>	22 216	84,2	0 – 9
			15,0	10 – 249
			0,8	250 +
	<b>F</b>	21 987	91,6	0 – 9
			8,2	10 – 249
			0,2	250 +
	<b>G</b>	41 834	92,5	0 – 9
			7,3	10 – 249
			0,2	250 +

Source: author's calculation based on Statistical Yearbook of the Republic of Croatia 2013, p. 226; Statistical Yearbook of the Republic of Croatia 2012, p. 222; Statistical Yearbook of the Republic of Croatia 2011, p. 223; Statistical Yearbook of the Republic of Croatia 2010, p. 577

Notes:

1. As in Table 2.
2. Due to rounding, structure's total may not equal exactly 100,0%.

At the level of the EU 27, presented data highlight distributive trade as an economic activity with the highest total of the active business enterprises, as well (Table 6.). Significant majority of micro enterprises (93,4% on average) opposes to the large enterprises whose share accounts for only 0,1%. Unlike recent downsizing developments present in Croatia, the number of enterprises engaged in distributive trade at the level of the EU 27 increases.

Table 6 Number of enterprises, by size class of number of persons employed, according to NACE Rev.2

Year	Economic activity	Total number of enterprises – EU 27	Structure, %	Enterprise size classes
<b>2008</b>	<b>F</b>	3. 297.727	92,6	0 – 9
			7,2	10 – 249
			0,1	250 +
	<b>G</b>	6.129.387	93,5	0 – 9
			6,4	10 – 249
			0,1	250 +
	<b>M</b>	3.431.852	96,2	0 – 9
			3,7	10 – 249
			0,1	250 +
<b>2009</b>	<b>F</b>	3.177.088	92,9	0 – 9
			7,0	10 – 249
			0,1	250 +

	G	6.065.504	93,3	0 – 9
			6,6	10 – 249
			0,1	250 +
	M	3.438.856	96,2	0 – 9
			3,7	10 – 249
			0,1	250 +
	2010	F	93,4	0 – 9
			6,6	10 – 249
			0,1	250 +
		G	93,5	0 – 9
			6,4	10 – 249
			0,1	250 +
		M	96,5	0 – 9
			3,5	10 – 249
			0,1	250 +
2011	F	3.244.741	93,4	0 – 9
			6,5	10 – 249
			: [0,1]	250 +
	G	6.229.767	93,3	0 – 9
			6,5	10 – 249
			0,1	250 +
	M	3.788.640	96,5	0 – 9
			3,5	10 – 249
			0,1	250 +

Source: author's calculation based on EUROSTAT data [online data codes: sbs\_sc\_sca\_r2, sbs\_na\_dt\_r2, sbs\_sc\_dt\_r2, sbs\_sc\_con\_r2 and sbs\_sc\_lb\_se\_r2, access: 18.06.2014.]

Notes:

1. As in Table 5.
2. : data not available but [calculated by an author under assumption of structure's total equals exactly 100,0%].

## 2.4. Number of persons employed within structural business statistics

Within structural business statistics, the same three economic activities with the highest total of active enterprises are the most significant employers in Croatia, as well (Table 7.). During the presented period, more than 250 000 persons employed on average emphasize distributive trade as the second most important employer within non-financial business economy, after Manufacturing, that confirms its earlier mentioned relevance as an employer. Data presented in the Table show a trend of decline in distributive trade, mainly in SMEs, whilst large enterprises operating with only 0,2% of total number of enterprises in distributive trade remain an important provider of jobs that continue to augment its already significant share.

Table 7 Number of persons employed in enterprises, by size classes of number of persons employed, according to NKD 2007.

Year	Economic activity	Total number of persons employed	Structure, %	Enterprise size classes
2008	C	316 658	15,7	0 – 9
			44,1	10 – 249
			40,2	250 +
	F	163 257	32,7	0 – 9
			46,4	10 – 249
			20,8	250 +
	G	276 786	36,0	0 – 9
			38,2	10 – 249
			25,7	250 +
2009	C	297 314	17,3	0 – 249
			36,6	10 – 19
			38,0	250 +
	F	160 144	35,9	0 – 9
			45,1	10 – 249
			19,0	250 +
	G	270 728	38,0	0 – 9
			36,1	10 – 249
			25,9	250 +
2010	C	281 220	17,1	0 – 9
			46,1	10 – 249
			36,8	250 +
	F	136 560	37,8	0 – 9
			43,5	10 – 249
			18,7	250 +
	G	250 642	37,4	0 – 9
			35,6	10 – 249
			27,0	250 +
2011	C	273 002	16,4	0 – 9
			46	10 – 249
			37,5	250 +
	F	120 587	36,6	0 – 9
			44,2	10 – 249
			19,0	250 +
	G	239 934	35,4	0 – 9
			36,2	10 – 249
			28,4	250 +

Source: As in Table 5.

Notes: As in Table 5.

In comparison to Croatia, some differences exist at the level of the EU 27. The three economic activities with the highest total of enterprises engaged in their performing are not the most significant in terms of persons employed (Table 8.). Additionally, as presented data highlight, distributive trade is the most important employer that reached in 2011 the highest absolute number of persons employed since 2008. Similarly to developments in Croatia, a majority of more than 70% on

average is employed by SMEs while micro enterprises increase their proportion in total employment as well as large enterprises that already provide a significant share of jobs in the EU 27.

Table 8 Number of persons employed in enterprises, hundreds, by size classes of number of persons employed, according to NACE Rev.2

Year	Economic activity	Total number of persons employed – EU 27	Structure, %	Enterprise size classes
2008	C	328.112	13,8	0 – 9
			45,7	10 – 249
			40,5	250 +
	F	144.867	43,4	0 – 9
			44,0	10 – 249
			12,7	250 +
	G	325.440	26,9	0 – 9
			33,5	10 – 249
			28,9	250 +
2009	C	304.091	13,7	0 – 9
			46,0	10 – 249
			40,1	250 +
	F	138.999	45,1	0 – 9
			42,5	10 – 249
			12,3	250 +
	G	329.086	27,6	0 – 9
			34,5	10 – 249
			28,3	250 +
2010	C	300.000	14,3	0 – 9
			45,8	10 – 249
			39,9	250 +
	F	134.913	45,9	0 – 9
			42,0	10 – 249
			12,0	250 +
	G	327.914	36,7	0 – 9
			35,0	10 – 249
			28,4	250 +
2011	C	301.000	14,3	0 – 9
			45,6	10 – 249
			40,2	250 +
	F	130.147	45,2	0 – 9
			42,6	10 – 249
			12,3	250 +
	G	330.130	36,1	0 – 9
			35,0	10 – 249
			28,8	250 +

Source: author's calculation based on EUROSTAT data [online data codes: sbs\_sc\_sca\_r2, sbs\_sc\_ind\_r2, sbs\_sc\_con\_r2 and sbs\_sc\_dt\_r2, access: 19.06.2014.]

Notes: As in Table 5.

## 2.5. Turnover within structural business statistics

In spite of the general decline in turnover within reference period in Croatia, distributive trade remains the economic activity that generates the highest absolute turnover within non-financial business economy (Table 9.). While large enterprises increase their proportion of turnover in distributive trade, SMEs still generate more than its 68%.

Table 9 Turnover of enterprises, thousand kn, by size classes of number of persons employed, according to NKD 2007

Year	Economic activity	Total turnover, 000 kn	Structure, %	Enterprise size classes
2008	C	157 803 707	8,6	0 – 9
			38,6	10 – 249
			52,8	250 +
	F	75 990 984	23,1	0 – 9
			47,8	10 – 249
			29,1	250 +
	G	264 510 847	20,6	0 – 9
			50,5	10 – 249
			28,9	250 +
2009	C	127 894 579	9,8	0 – 9
			41,2	10 – 249
			49,0	250 +
	F	68 356 629	25,3	0 – 9
			46,2	10 – 249
			28,5	250 +
	G	225 409 191	21,2	0 – 9
			48,3	10 – 249
			30,5	250 +
2010	C	125 215 805	10,0	0 – 9
			41,2	10 – 249
			48,9	250 +
	F	51 486 305	26,4	0 – 9
			46,7	10 – 249
			27,0	250 +
	G	214 247 813	20,0	0 – 9
			48,3	10 – 249
			31,8	250 +
2011	C	128 557 468	9,4	0 – 9
			40,2	10 – 249
			50,3	250 +
	F	46 030 708	27,4	0 – 9
			46,5	10 – 249
			26,1	250 +
	G	221 044 342	19,2	0 – 9
			49,2	10 – 249
			31,7	250 +

Source: author's calculation based on Statistical Yearbook of the Republic of Croatia 2013, p. 227; Statistical Yearbook of the Republic of Croatia 2012, p. 223; Statistical Yearbook of the Republic of Croatia 2011, p. 224; Statistical Yearbook of the Republic of Croatia 2010, p. 578  
Notes: As in Table 5.

At the level of the EU 27, distributive trade is not only the most important economic activity by the number of enterprises it engages in and by persons employed, but by the highest turnover as well (Table 10.). In comparison to other observed economic activities in the EU 27 and unlike to developments in Croatia, distributive trade succeeded in recovering in terms of turnover and break its 2008 level after drop in 2009. As in Croatia, large enterprises continue to increase their share in the structure of turnover at the account of the still prevailing SMEs that generate more than its 66% within reference period.

Table 10 Turnover of enterprises, million €, by size classes of number of persons employed, according to NACE Rev.2

Year	Economic activity	Total turnover or gross premium written – EU27	Structure, %	Enterprise size classes
2008	C	7.140.000	5,7	0 – 9
			: [34,1]	10 – 249
			60,2	250 +
	F	1.918.098	35,4	0 – 9
			44,7	10 – 249
			19,8	250 +
	G	9.112.422	16,9	0 – 9
			: [50,6]	10 – 249
			32,5	250 +
2009	C	5.810.000	5,8	0 – 9
			34,1	10 – 249
			59,8	250 +
	F	1.600.431	34,8	0 – 9
			44,8	10 – 249
			20,4	250 +
	G	8.229.705	22,2	0 – 9
			44,1	10 – 249
			33,6	250 +
2010	C	6.410.000	5,6	0 – 9
			33,6	10 – 249
			60,7	250 +
	F	1.553.890	36,2	0 – 9
			43,9	10 – 249
			19,8	250 +
	G	8.870.866	22,5	0 – 9
			43,9	10 – 249
			33,8	250 +
2011	C	7.000.000	5,6	0 – 9
			33,2	10 – 249
			61,1	250 +

	F	1.559.989	34,9	0 – 9
			44,8	10 – 249
			20,3	250 +
	G	9.506.673	21,7	0 – 9
			: [44,6]	10 – 249
			33,7	250 +

Source: author's calculation based on EUROSTAT data [online data codes: sbs\_na\_ind\_r2, sbs\_sc\_sca\_r2, sbs\_sc\_ind\_r2, sbs\_sc\_con\_r2 and sbs\_sc\_dt\_r2, access: 19.06.2014.]

Notes: As in Table 6.

## 2.5. Value added within structural business statistics

As with turnover, there is a general decline in value added within reference period in Croatia, as well, that ranks distributive trade to the second place, just after Manufacturing (Table 11.). Additionally, large enterprises engaged in distributive trade increase their contribution in the value added at the account of SMEs whose participation is more than 71% on average.

Table 11 Value added at factor costs of enterprises, thousand kn, by size classes of number of persons employed, according to NKD 2007.

Year	Economic activity	Total value added at factor costs, 000 kn	Structure, %	Enterprise size classes
2008	C	44 093 673	8,7	0 – 9
			40,1	10 – 249
			51,0	250 +
	F	22 238 509	21,4	0 – 9
			50,3	10 – 249
			28,4	250 +
	G	37 924 867	24,3	0 – 9
			50,0	10 – 249
			25,7	250 +
2009	C	37 904 599	9,2	0 – 9
			42,9	10 – 249
			47,9	250 +
	F	20 843 942	22,2	0 – 9
			47,3	10 – 249
			30,4	250 +
	G	32 818 841	25,3	0 – 9
			46,7	10 – 249
			27,9	250 +
2010	C	36 088 668	8,9	0 – 9
			42,5	10 – 249
			48,6	250 +
	F	16 071 191	21,2	0 – 9
			47,3	10 – 249
			31,5	250 +
	G	29 925 593	23,6	0 – 9
			46,0	10 – 249
			30,4	250 +
2011	C	35 610 024	8,1	0 – 9

	F	12 698 409	41,6	10 – 249
			50,3	250 +
			21,9	0 – 9
			49,8	10 – 249
	G	29 775 805	28,3	250 +
			22,2	0 – 9
			47,4	10 – 249
			30,4	250 +

Source: author's calculation based on Statistical Yearbook of the Republic of Croatia 2013, p. 227; Statistical Yearbook of the Republic of Croatia 2012, p. 223; Statistical Yearbook of the Republic of Croatia 2011, p. 224; Statistical Yearbook of the Republic of Croatia 2010, p. 578  
Notes: As in Table 5.

At the level of the EU 27, distributive trade is ranked as second, after Manufacturing, as well (Table 12.). Unlike developments in Croatia, distributive trade has recovered after a drop in value added in 2009 and reached its peak value in 2011. Already predominant proportion of the SMEs that account for more than 68% on average is additionally strengthened by the most recent developments in the structure of value added.

Table 12. Value added at factor costs of enterprises, in million €, by size classes of number of persons employed, according to NACE Rev.2

Year	Economic activity	Value added at factor costs – EU 27	Structure, %	Enterprise size classes
2008	C	1.670.000	7,5	0 – 9
			: [38,6]	10 – 249
			53,9	250 +
	M	573.650	40,0	0 – 9
			37,8	10 – 249
			22,3	250 +
	G	1.151.266	20,5	0 – 9
			: [48,2]	10 – 249
			31,3	250 +
2009	C	1.400.000	: [7,7]	0 – 9
			38,5	10 – 249
			53,8	250 +
	M	519.000	38,4	0 – 9
			: [37,7]	10 – 249
			23,9	250 +
	G	1.109.543	24,8	0 – 9
			43,3	10 – 249
			31,9	250 +
2010	C	1.590.000	7,1	0 – 9
			37,4	10 – 249
			55,0	250 +
	M	560.532	39,8	0 – 9
			: [37,3]	10 – 249
			22,9	250 +



2011	G	1.145.812	25,9	0 – 9
			42,0	10 – 249
			32,3	250 +
	C	1.650.000	7,3	0 – 9
			37,6	10 – 249
			54,9	250 +
	M	580.427	39,7	0 – 9
			37,5	10 – 249
			22,8	250 +
	G	1.193.564	25,7	0 – 9
			: [42,6]	10 – 249
			31,7	250 +

Source: author's calculation based on EUROSTAT data [online data codes: sbs\_sc\_sca\_r2, sbs\_sc\_ind\_r2, sbs\_sc\_dt\_r2 and sbs\_sc\_lb\_se\_r2, access: 19.06.2014.]

Notes: As in Table 6.

### 3. CONCLUSION

The paper presented main findings on indicators usually used to measure the importance of distributive trade and deployed them to point out modern developments that have been occurring in Croatia and at the level of EU 27. A conclusion could be drawn on the existence of a significant degree of convergence among them. A trend of decline in the contribution of distributive trade in gross value added in the structure of GDP is present in Croatia as well as at the level of EU 27. In spite of that, distributive trade is still ranked as the second most important economic activity. Similar developments regarding employment and its proportion exist in Croatia as well as at the level of EU 27. Additional similarities are revealed by the structural business statistics. These are distributive trade's prevalence in the number of active business entities, dominance of micro enterprises in total number of business entities or multiannual constant proportion of large enterprises. Regarding persons employed, convergence can be seen in the majority employed by SMEs or rising influence of micro enterprises and large enterprises in employment. Data on turnover and value added in Croatia and at the level of EU 27 rank distributive trade at first and second place, respectively.

The verification of the findings could be included in the future research conducted at the more detailed level of analysis such as on the structure of the distributive trade's divisions.

### 4. REFERENCES

1. Croatian Bureau of Statistics: Statistical Yearbook of the Republic of Croatia 2013, Zagreb, 2013
2. Croatian Bureau of Statistics: Statistical Yearbook of the Republic of Croatia 2012, Zagreb, 2012

3. Croatian Bureau of Statistics: Statistical Yearbook of the Republic of Croatia 2011, Zagreb, 2011
4. Croatian Bureau of Statistics: Statistical Yearbook of the Republic of Croatia 2010, Zagreb, 2010
5. EUROSTAT: Statistics database, [available at:  
[http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search\\_database](http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database),  
access: 17.06. – 19.06.2014.]
6. Knego, N. (2004.) Značaj distributivne trgovine u gospodarstvima EU i Republike Hrvatske, Suvremenatrgovina, Zagreb, No. 4.

## **II. SUPPLY CHAIN MANAGEMENT – ICT ENVIRONMENT AND SECURITY**



## **A JOINT MATURITY MODEL OF BI-DRIVEN SUPPLY CHAINS**

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*Scientific paper*

### ***Abstract***

Information technology (IT) and performance measurement are of rising value in globally connected supply chains. This results in the increasing implementation of business intelligence (BI) applications to enhance information exploitation as strategic and operational competitive advantages. To estimate the degree of maturity in supply chains as well as for BI solutions, maturity models are used. There exist numerous specific maturity models for supply chains, also in strong interrelationship with investigations on evolution stages of supply chains. Furthermore, certain BI maturity models are covering different perspectives to assess the degree of BI utilization in companies. The aim of this paper is two-folded. First, maturity dimensions should be isolated and extracted from given models. Second, a joint maturity approach by merging key dimensions of supply chain and BI maturity for BI-driven supply chains will be developed. In this context, BI-driven supply chains are a summarizing term for advanced supply chains in which efforts to base decisions on joint KPIs and metrics are strengthened as well as joint planning and collaborative forecasting activities are executed. Contribution to research is made by the combination of supply chain and BI maturity approaches.

**Key words:** Supply chain management, maturity models, business intelligence

### **1. INTRODUCTION**

In times of increasing amounts of data from several sources like log and transactional data in supply chains or the deluge of unstructured online data (Sethuraman, 2012, p. 1), different techniques to handle and facilitate upcoming big

data problems are approached. Especially in the domain logistics and supply chain management (SCM), the "collection and the exchange of data" (Garrido Azevedo et al., 2007, p. 8) are assessed as critical. Moreover, emerging information technologies (IT) as innovative solutions to improve overall process and performance quality in SCM (Hausladen et al., 2013, p. 166) are identified as momentous for "supporting cross-firm relationships" (Daugherty, 2011, p. 26). In the context of the later proposed research questions, the application of BI to face big data issues becomes crucial. Beside the generation of data in supply chains through telematics, logging data and data out of ERP and peripheral systems, the ability of collecting, processing and analyzing data to support decisions in supply chain management needs to be addressed. A recent survey among supply chain leaders revealed that only one third have implemented initiatives to handle big data problems yet (Cecere, 2013). Standards and models to combine IT and SCM aspects should therefore anticipate big data as an opportunity. Maturity models try to answer this question by evaluating these data-intensive domains, show the status quo of SCM and BI efforts and give implications for future developments.

Prior to express the specific research question of this paper, relevant terms need to be defined and delimited. SCM „encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities“ (Council of Supply Chain Management Professionals (CSCMP), 2013, p. 187) including warehousing, distribution and after sales services with a strong focus on end-to-end value chains and customer requirements. To emphasize deeper on interorganizational issues, the domain logistics is therefore neglected in the forthcoming analysis since it follows a more operational focus (Hausladen et al., 2013, p. 164). Business intelligence is defined as an integrated and holistic approach which uses data from business transactions and beyond to generate and optimize business decisions (The Data Warehousing Institute, 2014; Gendron, 2013, p. 4). Maturity models can be viewed either from a lifecycle perspective to achieve a final evolution stage by evolving over time or from a potential performance perspective, i.e. the maturity level is assessed and can be enhanced by doing certain improvements (Wendler, 2012, p. 1318). Basically, maturity models are a „sequence of maturity levels for a class of objects“ (Becker et al., 2009, p. 213) which depicts a typical evolution path. According to Fraser et al. (2002), maturity models typically consist of a number of levels, a descriptor for and a generic description of each level, a certain amount of dimensions which are also broken down to a number of elements or activities containing detailed descriptions for each maturity stage (Fraser et al., 2002, p. 246). The evolutionary stages are also the crucial element when delimitating maturity models from lifecycle approaches. A lifecycle shows different conditions during its steps as well as positive and/ or negative alterations by shifting from phase to phase, whereas stages in maturity models evolve in a positive way.

In this paper, we propose the following research questions:

- (1) How far can we extract dimensions from maturity approaches in SCM and BI?
- (2) Is it possible to map these dimensions and merge them into a joint maturity approach for BI-driven supply chains?

These research questions reflect the aims and also the structure of the aspired procedure. At first, maturity models in SCM and BI are presented in chapter 2. Then, the presented maturity models are analyzed in chapter 3 to isolate and extract key dimensions describing the individual maturity stages in the SCM and BI domain. Finally, a joint approach is suggested by mapping and merging dimensions from SCM and BI maturity models.

## **2. MATURITY MODELS IN SUPPLY CHAIN MANAGEMENT AND BUSINESS INTELLIGENCE**

Numerous maturity models in SCM and BI have been constructed and proposed over years. Lahti et al. (2009) give a detailed overview over selected SCM maturity models and construct their own model based on prior analyses (Lahti et al., 2009). Concerning the BI domain, comprehensive compilations and analyses are provided by Raber (2014) (Raber, 2014) and Hribar Rajterič (2010) (Hribar Rajterič, 2010). Selected maturity models in SCM and BI are presented in the following, whereas the selection was based either on their popularity or on their relative ability to extract dimensions.

### **2.1. Maturity models in Supply Chain Management**

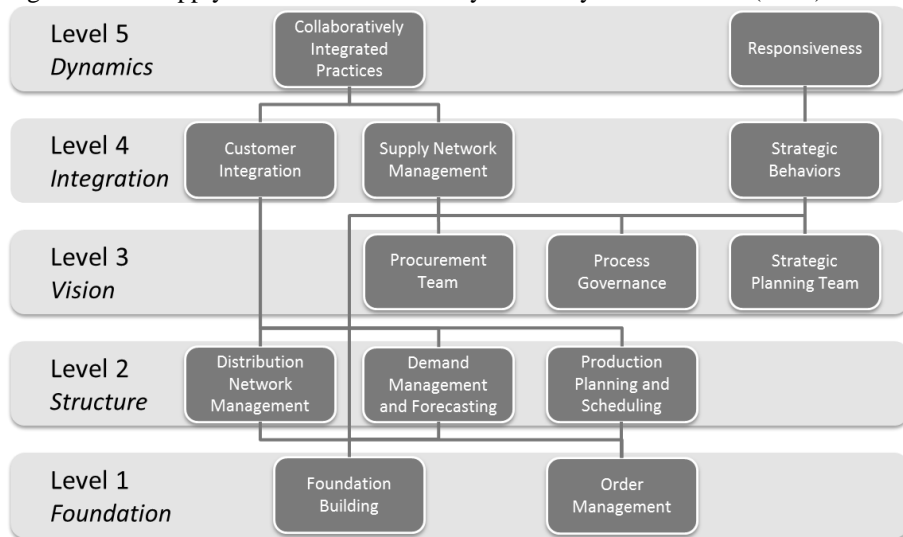
Maturity models in SCM share the common idea of defining a certain amount of maturity levels which are also enriched with typical information and performance descriptions (Lahti et al., 2009, p. 657).

A common construct is the supply chain management process maturity model by Lockamy III & McCormack (2004), which is mainly based on business process orientation (BPO) concerning maturity improvements (Lockamy III & McCormack, 2004, p. 273). Influenced by the capability maturity model (CMM/ CMMI), the SCM maturity model consists of the five incremental stages Ad Hoc, Defined, Linked, Integrated and Extended, in which a textual description of the maturity condition takes place (Lockamy III & McCormack, 2004, p. 275). The SCM maturity model is conceptualized toward SCM using the Supply Chain Operations Reference (SCOR) model. As proposed by Lockamy III & McCormack (2004), supply chain practices, that describe the execution of one or more processes (Supply Chain Council, 2012, p. 21), and procedures are purely viewed from a process perspective. Therefore, BPO maturity attributes organized in process views, structures, etc. and process capability measures like predictability or efficiency are taken into account to operationalize SCM maturity (Lockamy III & McCormack, 2004, p. 273).

Evolved out of the SCM maturity model, Oliveira et al. (2011) developed this approach further by integrating specific process groups into each maturity level. Although the model also consists of five stages, it follows an approach leaving the BPO layer and facing more toward a SCM view (Oliveira et al., 2011, p. 209). This is done by a Foundation level 1 maturity stage over the Structure and Vision stage, where the networks and processes should fully be managed. In addition, process

groups describing integration (level 4 – Integration) and collaboration issues (level 5 – Dynamics) complete the maturity approach (Oliveira et al., 2011, p. 209). A special feature of this approach is the concrete application of a questionnaire comprising of 4-10 questions for every maturity process group each to apply the model and assess the current state of supply chain maturity (Oliveira et al., 2011, pp. 214–217). The maturity stages and the process groups are illustrated in Figure 1.

Figure 1 The Supply Chain Process Maturity Model by Oliveira et al. (2011)



Source: Oliveira et al., 2011, p. 209

After analyzing six maturity models, Lahti et al. (2009) developed a four-stage maturity model which mainly focuses on integration issues and shows some similarities with the evolution path of supply chains in general (Stevens, 1989, p. 7). Nevertheless, the stages of Functional, Internal, External and finally Cross-Enterprise Integration are narrowed down to 16 sub-areas assigned to the four SCOR-oriented categories Plan, Source, Make, Deliver and additional Overall as a supply chain wide perspective (Lahti et al., 2009, p. 674). Like in the previous presented maturity model, a questionnaire with over 100 questions delivers the basis for assessing the maturity level. Furthermore, by using the questionnaire assessment and concrete sub-areas, implications on dominant or current and future practices as well as benchmarks when comparing different organizations can be given (Lahti et al., 2009, pp. 671–674).

## 2.2. Maturity models in Business Intelligence

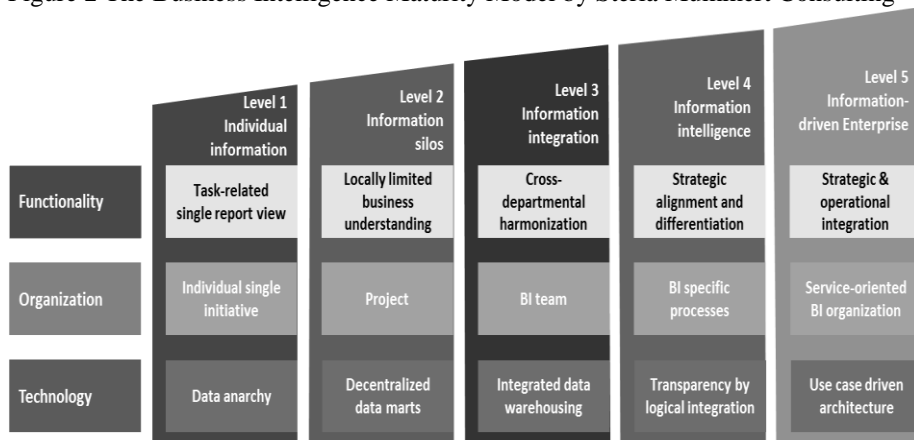
Maturity models in IT and especially in the area of BI are gaining some widespread attention. In comparison with maturity models in SCM, research begun a decade earlier and generate concrete models and even international standards like



CMM/ CMMI, SPICE or COBIT. Therefore, these models are far more developed and refined.

A detailed maturity model tailored for BI is the biMM (Business Intelligence Maturity Model) by Steria Mummert Consulting, which is also used to present the annual status quo of BI in Europe (Dittmar et al., 2013). In this model, five levels with a strong information background span the range of maturity characterized by the three dimensions functionality, organization and technology, which is completely illustrated in Figure 2. For every dimension, the stage of maturity is assessed by a relevant set of elements or activities for each element. For instance, service-oriented BI organization (dimension organization at maturity level 5) is described by continual process improvements or best-fit-sourcing among others (Dittmar et al., 2013, p. 26).

Figure 2 The Business Intelligence Maturity Model by Steria Mummert Consulting



Source: Dittmar & Oßendoth, 2013, p. 7

Another seminal model is the BI maturity model developed within The Data Warehousing Institute (TDWI). This approach divides the maturity of BI into the five stages Nonexistent, Preliminary, Repeatable, Managed and Optimized, refined by the eight key dimensions scope, sponsorship, funding, value, architecture, data, development, and delivery (Gonzalez, 2012, p. 3). A specialty of TDWI's maturity model is the integration of two certain barriers between stages, in particular the Gulf between the Nonexistent and Preliminary and the Chasm between the Repeatable and the Managed stage. In the model, advice and challenges are compiled to successfully overcome these barriers and reach the next stage (Gonzalez, 2012, pp. 3–10).

As detected by Tan et al. (2011), enterprise-wide BI initiatives as well as their maturity assessments are limited in research. Seizing this gap, they propose a Maturity Model of Enterprise BI, which is, from a maturity stage's point of view, based on the CMM/ CMMI approach and consists of the five stages Initial, Repeatable, Defined, Managed and Optimizing (Tan et al., 2011, pp. 1–3). The maturity model aspires a more IT-related direction and uses the four dimensions

information quality, master data management, warehousing architecture and analytics to describe the different maturity levels in detail (Tan et al., 2011, pp. 4–5).

By contrast, Ong et al. (2011) developed a BI maturity model with respect to an organizational perspective after analyzing different BI maturity models. This was done by reviewing, matching and reducing especially the dimensions of five different maturity models to four basic dimensions and arrange them on a not otherwise specified five-stage maturity scale (Ong et al., 2011, p. 3).

### 3. MAPPING OF SCM AND BI MATURITY MODELS

Dimensions provide a characteristic structure to maturity models and are commonly seen as specific capability areas which are structuring fields of interest and describing different issues of the maturity assessment's object (Lahrman & Marx, 2010, p. 522; Raber, 2014, p. 64). They are determined and detailed by practices, measures or activities at each stage of maturity (Fraser et al., 2002, p. 246). The aim of this analysis is to extract maturity dimensions from both perspectives SCM and BI and merge them into a joint maturity approach.

#### 3.1. Extraction of key dimensions from SCM maturity models

As seen in 2.1, the maturity model proposed by Lockamy III & McCormack (2004) is based on a BPO approach. Here, several process maturity attributes like process view or structures are introduced, which are explained in Table 1. Furthermore, the four detailed process goals predictability, control, effectiveness and efficiency as marking thresholds between maturity levels are suggested (Lockamy III & McCormack, 2004, p. 274).

By contrast, Oliveira et al. (2011) use no specific dimensional approach and orient their maturity scale on a set of process groups which also stand for achieved or to-be conditions in the respective maturity stage (Oliveira et al., 2011, p. 209).

While Lockamy III & McCormack (2004) used the SCOR model only cursory to conceptualize their maturity model, Lahti et al. (2009) expand a part of its major processes Plan, Source, Make and Deliver to a dimensional maturity approach, which is also depicted and explained in Table 1.

Table 1 Summary of dimensions in the field of SCM maturity models

Author	Dimensions	Explanation
Lockamy III & McCormack (2004)	<ul style="list-style-type: none"> <li>• Process view</li> <li>• Process structures</li> <li>• Process jobs</li> <li>• Process measures</li> <li>• Process values</li> </ul>	<ul style="list-style-type: none"> <li>• Process definition and documentation</li> <li>• Teams, collaboration and integration</li> <li>• Ownership, authority and influence</li> <li>• Definition, ownership and linkages</li> <li>• Customer focus, credibility and trust</li> </ul>
Oliveira et al. (2011)	<ul style="list-style-type: none"> <li>• Process groups</li> </ul>	<ul style="list-style-type: none"> <li>• Varied process groups which show different tasks in maturity</li> </ul>
Lahti et al. (2009)	<ul style="list-style-type: none"> <li>• Plan</li> <li>• Source</li> <li>• Make</li> </ul>	<ul style="list-style-type: none"> <li>• Strategy, demand and supply planning</li> <li>• Sourcing and supplier management</li> <li>• Manufacturing and scheduling</li> </ul>

	<ul style="list-style-type: none"> <li>• Deliver</li> <li>• Overall</li> </ul>	<ul style="list-style-type: none"> <li>processes</li> <li>• Order and warehouse management</li> <li>• Supply chain metrics and developments</li> </ul>
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Source: Lockamy III & McCormack, 2004, p. 274; Oliveira et al., 2011, p. 209; Lahti et al., 2009, p. 674

### 3.2. Extraction of key dimensions from BI maturity models

As mentioned above, maturity models in BI are much more advanced comparing to SCM. This is also reflected concerning the elaboration of maturity dimensions. In biMM, three dimensions differentiate the view of maturity into a business or content-related (functionality), a structural (organization) and a BI-specific perspective (technology). Within functionality, the validity of the content delivered by the BI application is tested and verified as well as the usability and the degree of decision and analytics process support. The organizational dimension addresses the embeddedness of the BI application in a process and procedure structure of a company, therefore also the degree of institutionalization and formalization. Furthermore, strategic and economic aspects of BI initiatives are depicted. Finally, flexibility, quality and technical functionality of the realized BI solution are reflected through the technology perspective, which is also considering the data architecture and the degree of standardization or customization (Dittmar et al., 2013, p. 68).

TDWI's BI maturity model arranges its maturity levels around eight dimensions, which are shown in detail in Table 2.

Table 2 Dimensions of TDWI's BI maturity model

Dimension	Explanation
Scope	To what extent does the BI/ (data warehouse) DW program support all parts of the organization and all potential users?
Sponsorship	To what degree are BI/ DW sponsors engaged and committed to the program?
Funding	How successful is the BI/ DW team in securing funding to meet business requirements?
Value	How effectively does the BI/ DW solution meet business needs and expectations?
Architecture	How advanced is the BI/ DW architecture, and to what degree do groups adhere to architectural standards?
Data	To what degree does the data provided by the BI/ DW environment meet business requirements?
Development	How effective is the BI/ DW team's approach to managing projects and developing solutions?
Delivery	How aligned are reporting/ analysis capabilities with user requirements and what is the extent of usage?

Source: Gonzalez, 2012, pp. 10–11

Following a more technical lane, Tan et al. (2011) structure their BI maturity model by means of four dimensions. The dimension of information quality incorporates all aspects concerning data and resulting information quality. Master data management addresses issues like access and business rules and an enterprise-wide data convergence. The design of analytics services within the company, evolving from spread marts to enterprise-wide services, is addressed through the dimension warehousing architecture. Lastly, the dimension analytics describes the capability of shifting analytical efforts toward a competitive factor (Tan et al., 2011, pp. 4–5).

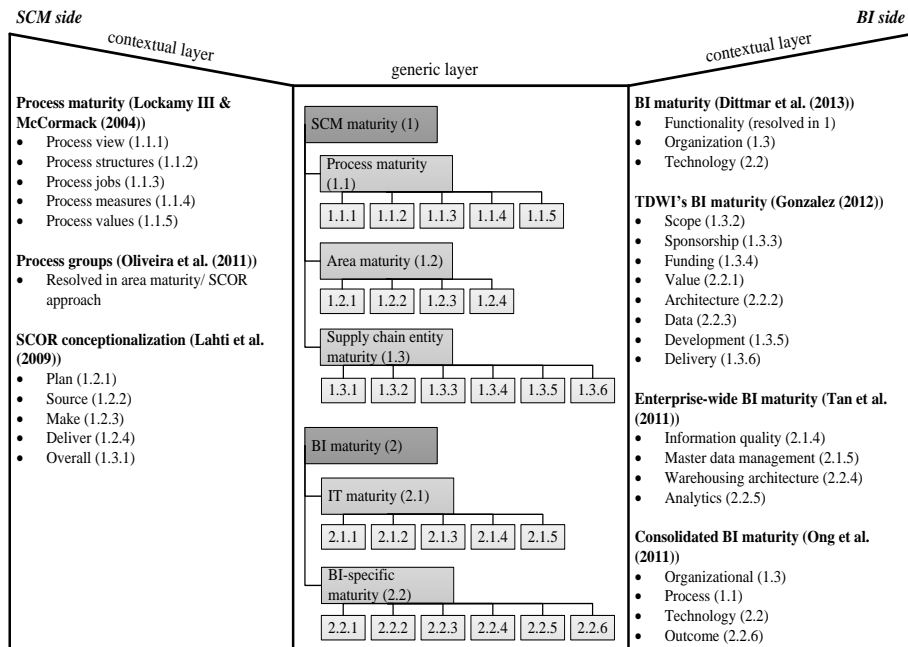
To conclude with a broader view, Ong et al. (2011) propose four consolidated dimensions. Whereas the organizational dimension includes elements like vision, goals, scope, governance, training and strategic alignment, the process dimension covers change and data management as well as data governance and implementation issues. Data warehousing and the application of certain technology types like OLAP are included in the technology dimension. Finally, the dimension of outcome aims at the resulting data and information quality expressed in metrics and KPIs (Ong et al., 2011, p. 3).

### **3.3. Mapping the key dimensions to create a joint maturity approach**

Given that the amount of data in supply chains is steadily increasing and big data issues are heavily discussed in research and practice, we propose a paradigm shift from common supply chains to BI-driven supply chains to face this development. According to CSCMP (2013), supply chains refer to material and information linkages and interchanges starting with raw material and ending with final customers (CSCMP, 2013, p. 186). We need to emphasize further on information generation and data exploitation involved in supply chain decisions to enhance supply chains toward more agility. A cornerstone of these activities may be a joint maturity approach combining SCM and BI dimensions.

After the extraction of maturity dimensions took place, the dimensions out of the SCM and BI perspective should be mapped using a hierarchical dimension approach. Here, we constructed a model consisting of two contextual layers (SCM and BI side) and merge the given maturity dimensions into a generic dimensional layer for a joint maturity model of BI-driven supply chains, which is illustrated in detail in Figure 3. As we have identified different hierarchical levels of maturity dimensions, some dimensions from the used maturity models are partly resolved in new generic dimensions or in the first hierarchical levels (e.g. (1.3) supply chain entity maturity). To avoid overlaps concerning the SCM and BI side, all organizational and functional/ content-related dimensions coming from the BI side were integrated in the dimension of supply chain entity maturity, which reflects the supply chain as a holistic construct. Thus, a distinction between supply chain areas like Source and the supply chain as a construct was done as well. Concerning BI maturity in the joint model, it is necessary to assess IT maturity like information quality likewise since it provides a substantial requirement for BI maturity. A clean separation of SCM and BI dimensions is therefore inevitable to reflect a deep application of one technical approach within an organizational construct.

Figure 3 A dimensional maturity framework for BI-driven supply chains



Source: own illustration

The overall intent of the mapping approach is to create a joint perspective of BI and SCM maturity since previous maturity investigations were only undertaken in an isolated way. Likewise, business processes and the corresponding IT infrastructure are often designed and implemented without addressing the relations between them (cp. Hausladen, 2014, pp. 236-237). By using this approach, the functional – supply chain management and its processes – and the technical perspective – IT and its structure – should be combined. This can be executed by choosing a cross-functional project team to assess and enhance the maturity of a BI-driven supply chain. Here, focal companies, if existing, take over an important role to foster the practical implementation of the proposed approach.

#### 4. CONCLUSION

In this paper, we show the diversities of maturity models in SCM and BI. To construct a joint framework for the maturity of BI-driven supply chains and successfully answer the prior proposed research questions, the dimensions structuring the maturity approaches are firstly extracted and secondly mapped within a single framework. Concerning SCM maturity, a focus on a SCOR- and process-based evaluation was revealed during the analysis. By contrast, maturity models in BI are far more developed, therefore a bigger set of dimensions was extracted and

dominance of BI maturity was detected. However, a joint dimensional maturity framework for BI-driven supply chains was developed on a theoretical basis by using hierarchies among dimensions and a separation into a content- and process-related and a technical perspective.

To follow a holistic approach, further research activities could be activated by picking up the suggested framework, creating a robust questionnaire for each detailed dimension in every second level and execute an industry survey among enterprises linked in the same supply chain to firstly validate the maturity model and secondly apply it in practice. To enhance this practice, different supply chains could be surveyed and benchmarked. Moreover, relationships between information and supply chains should be deeper analyzed to leverage a concept of BI-driven supply chains.

## 5. REFERENCES AND SOURCES OF INFORMATION

1. Becker, J., Knackstedt, R. and Pöppelbuß, J. (2009). Developing Maturity Models for IT Management, *Business & Information Systems Engineering*, Vol. 1 No. 3, pp. 213–222.
2. Cecere, L. (2013). A Quantitative Study on the Evolution of Big Data (Supply Chain) Concepts, available at: [http://www.supplychain247.com/article/a\\_quantitative\\_study\\_on\\_the\\_evolution\\_of\\_big\\_data\\_supply\\_chain\\_concepts](http://www.supplychain247.com/article/a_quantitative_study_on_the_evolution_of_big_data_supply_chain_concepts)
3. Council of Supply Chain Management Professionals (CSCMP) (2013). Supply Chain Management: Terms and glossary, available at: [http://cscmp.org/sites/default/files/user\\_uploads/resources/downloads/glossary-2013.pdf](http://cscmp.org/sites/default/files/user_uploads/resources/downloads/glossary-2013.pdf)
4. Daugherty, P.J. (2011). Review of logistics and supply chain relationship literature and suggested research agenda, *International Journal of Physical Distribution & Logistics Management*, Vol. 41 No. 1, pp. 16–31.
5. Dittmar, C. & Oßendoth, V. (2013). Ist die Wahrheit noch zu retten?: Ergebnisse der Europäischen Business Intelligence Maturity Audit Studie (biMA@2012/13), IBM Information Management Forum, April, 2013.
6. Dittmar, C., Oßendoth, V., Schulze, K.-D. (2013). Business Intelligence: Status quo in Europa: Europäische biMA-Studie 2012/2013, Steria Mummert Consulting.
7. Fraser, P., Moultrie, J., Gregory, M. (2002). The use of maturity models/grids as a tool in assessing product development capability, 2002 IEEE International Engineering Management Conference, 2002. IEMC '02., Vol. 1, pp. 244–249.
8. Garrido Azevedo, S., Ferreira, J., Leitão, J. (2007). The Role of Logistics' Information and Communication Technologies in Promoting Competitive Advantages of the Firm, MPRA Paper No. 1359.
9. Gendron, M.S. (2013). Business Intelligence Applied: Implementing an Effective Information and Communications Technology Infrastructure, John Wiley & Sons, Hoboken.

10. Gonzalez, M.L. (2012). TDWI Benchmark Guide: Interpreting Benchmark Scores Using TDWI's Maturity Model.
11. Hausladen, I. (2014). IT-gestützte Logistik. Systeme, Prozesse, Anwendungen. 2nd edition, Gabler, Wiesbaden
12. Hausladen, I., Haas, A., Lichtenberg, A. (2013). Contribution of Emerging IT Solutions to Sustainable Logistics and Supply Chain Management - a Theoretical Framework Analysis, 10th International Conference on Logistics & Sustainable Transport, Celje, Slovenia, pp. 164–174.
13. Hribar Rajterič, I. (2010). Overview of business intelligence maturity models, Management: Journal of Contemporary Management Issues, Vol. 15 No. 1, pp. 47–67.
14. Lahrman, G. & Marx, F. (2010). Systematization of Maturity Model Extensions, in Winter, R., Zhao, J.L. and Aier, S. (Eds.), Global perspectives on design science research: 5th international conference, DESRIST 2010, St. Gallen, Switzerland, June 4-5, 2010 proceedings, LNCS sublibrary. SL 3, Information systems and applications, incl. internet/web, and HCI, Vol. 6105, Springer, Berlin, pp. 522–525.
15. Lahti, M., Shamsuzzoha, A., Helo, P. (2009). Developing a maturity model for Supply Chain Management, International Journal of Logistics Systems and Management, Vol. 5 No. 6, p. 654.
16. Lockamy III, A. & McCormack, K. (2004). The development of a supply chain management process maturity model using the concepts of business process orientation, Supply Chain Management: An International Journal, Vol. 9 No. 4, pp. 272–278.
17. Oliveira, M.P.V. de, Bronzo, M., P., McCormack, K. (2011). The Supply Chain Process Management Maturity Model - SCPM3, in Onkal, D. (Ed.), Supply Chain Management - Pathways for Research and Practice, InTech, pp. 201–218.
18. Ong, I.L., Siew, P.H., Wong, S.F. (2011). Assessing organizational business intelligence maturity, 2011 International Conference on Information Technology and Multimedia (ICIM), pp. 1–6.
19. Raber, D. (2014). Reifegradmodellbasierte Weiterentwicklung von Business Intelligence im Unternehmen, Dissertation, Universität St. Gallen, St. Gallen, 2014.
20. Sethuraman, M. (2012). Big Data's Impact on the Data Supply Chain, available at: <http://www.cognizant.com/InsightsWhitepapers/Big-Datas-Impact-on-the-Data-Supply-Chain.pdf>.
21. Stevens, G.C. (1989). Integrating the Supply Chain, International Journal of Physical Distribution & Logistics Management, Vol. 19 No. 8, pp. 3–8.
22. Supply Chain Council (2012). SCOR 11 Upgrade Webinar Slides, available at: <https://supply-chain.org/scor-11-upgrade-webinar-slides>.
23. Tan, C.-S., Sim, Y.-W., Yeoh, W. (2011). A Maturity Model of Enterprise Business Intelligence, Communications of the IBIMA, pp. 1–9.
24. The Data Warehousing Institute (2014). Business Intelligence -- TDWI -The Data Warehousing Institute, available at: <http://tdwi.org/portals/business-intelligence.aspx>.

25. Wendler, R. (2012). The maturity of maturity model research: A systematic mapping study, *Information and Software Technology*, Vol. 54 No. 12, pp. 1317–1339.



## **CHANGES OF SUPPLY CHAIN MANAGEMENT IN THE INFORMATION TECHNOLOGY INDUSTRY AS FUNCTION OF SUSTAINABLE DEVELOPMENT**

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*Scientific paper*

### ***Abstract***

One of the world's strongest industries – information technology (IT) industry, is constantly facing ever increasing need for change. A short life cycle of IT products and continuous investment in innovation (production, distribution, recycling) led to a significant evolution of supply chain management, where environmental issues are top priority.

Through a completely new approach – high cooperation, partnerships, presence of many companies, more and more complex data and improved response times, today's multiple IT supply chains involve immense number of activities, not only to reach the business goals, but to take care of the environment and sustainability as well. Social issues (supply chain greening), product distribution choice, hub selection and production closer to customers (near-shoring) make the industry less polluting.

This paper presents some examples of IT supply chain adjustments to the environmental requirements and legislations, through the analyses of the world's biggest IT company – Hewlett-Packard.

**Key words:** sustainable supply chain management, environment, sustainability, greening, savings

### **1. INTRODUCTION**

In the recent years, companies have recognized that the profit is only one of the elements of long-term success. Interest in green and sustainable supply chain (SC)

has been growing over the last decade. The issue of sustainable supply chain management (SSCM) has received growing attention and has become an increasingly popular researching area.

Companies are facing many new challenges – financial crisis, rapid climate changes, increasing public interest in ecology, as well as in environmental sustainability and energy efficiency. In many countries, environmental legislation increased concern with this issue. Holistic approach to sustainability makes overall impact to the sales of goods and services, supporting the entire life cycle throughout the SC. Sustainability initiatives often involve many participants in the SC in order to achieve the desired goal.

Financial results are not the only indicators of success. Modern company is driven both by the profit and appropriate degree of social responsibility – employees' rights and environmental protection.

In this paper, we will present some features and prospects of IT SSCM, considering the example of the world's largest IT company – Hewlett-Packard (HP). Their recent activities undertaken in order to make their SC sustainable will be analyzed.

## **2. LITERATURE REVIEW**

Sustainable development is defined as “a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. ...sustainable development is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs.” (WCED, 1987, p. 15-16).

According to Seuring and Müller we define sustainable chain management as "the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements. In sustainable supply chains, environmental and social criteria need to be fulfilled by the members to remain within the supply chain, while it is expected that competitiveness would be maintained through meeting customer needs and related economic criteria" (Seuring & Müller, 2008, p.1700).

Carter and Rogers define SSCM as the strategic achievement and integration of the organization's social, environmental and economic goals, through systemic coordination of key inter-organizational business processes to improve the long-term economic performance of the individual company and its value network (Carter & Rogers, 2008, p. 368).

It has become a global issue and more and more companies put efforts in trying to consider both environmental and social implications of their SC. On the other side, the studies conducted by Mejias and Pardo for the period between 1990 and 2011, has shown that there is only 105 scientific papers dedicated to this topic (Mejias & Pardo, 2013, p. 62).

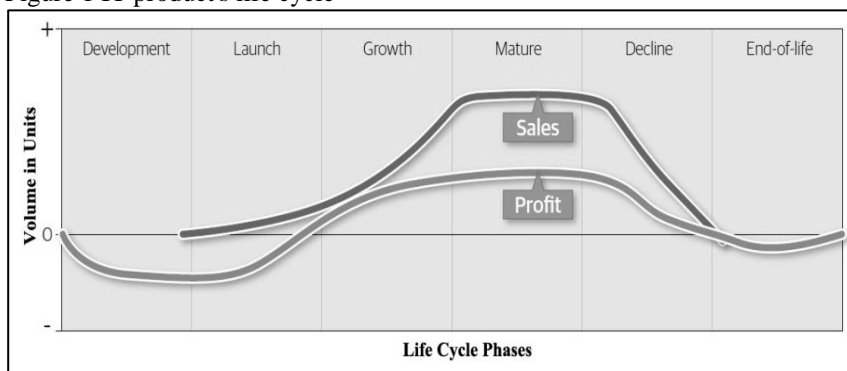
Recent research suggests that 30% of producers gain profit directly from sustainability initiatives (Blackhurst et al, 2012, p.1). Sustainability may be driven from within the company or may be the result of customer needs and pressures, as well as other supply chain partners. Modern SC has a huge number of participants which are located all over the world due to implemented global sourcing initiatives. This means that large companies have to ensure their partners adhere to SER (Social and Environmental Responsibility) standards, which often implies investment into their education (a good example is HP's project realized in the Czech Republic, Hungary and Slovakia<sup>17</sup>).

### 3. FEATURES AND PERSPECTIVES OF SUSTAINABLE SUPPLY CHAIN MANAGEMENT IN INFORMATION TECHNOLOGY INDUSTRY

As a global industry, IT is constantly looking for new supply sources, redefining the role of customer service, gaining better control of products' life cycles and finding ways to enter new markets more efficiently. One of the most important characteristics that differentiate IT from other industries is the complexity of SC, whereby most participants are business partners, included into the design and production of new products. IT effectively controls complex sales channels – distributors, dealers, partners, all the way to the end user. Majority of the data required to control SC operations are coming from external partners. Data collection, processing and utilization are complex tasks.

The fundamental nature of the IT industry is characterized by product's short life cycles products. Companies consider the entire life cycle of each individual product. Constant innovations are the reality of IT, also. Figure 1 illustrates 6 phases of an IT product's life cycle, with the implications each phase has on the sales and profit. The total profit equals the sum of the profits from all 6 phases.

Figure 1 IT product's life cycle



Source: Ellis S., 2013, p. 14

<sup>17</sup> „Small Suppliers in Global Supply Chains”, a report by Danish Commerce and Companies Agency in cooperation with Hewlett-Packard and suppliers in Central and Eastern Europe.

Designing SC is no longer a strategic decision, but rather a dynamic set of activities that continually consider arising opportunities and threats. Modern company operates as a network of companies - many business functions such as procurement, production, logistics, financial decisions and IT are often outsourced to specialized partners. Many of them are scattered all over the world. Today's SCs are longer, more dynamic and more complex.

Large IT companies have realized that the area of sustainable development has to be regulated – standards in the fields of labor, health care, safety, environment and ethics have to be set. Workers have to be treated with respect and dignity, business operations conducted environmentally responsible. Many positive experiences of SSCM enhancements could be seen in a comprehensive analysis of the operations of the IT world leader – Hewlett-Packard. Having dealt with this issue over the decades, HP has not only improved its market position, but increased efficiency and effectiveness, also. HP gave significant theoretical contribution used by many companies, even by its direct competitors.

#### **4. HEWLETT-PACKARD'S SUSTAINABLE SUPPLY CHAIN MANAGEMENT – DESIGN AND EVOLUTION**

HP's Global Citizenship activities promoted the company as the leader in the field of environmental sustainability. HP has identified three priorities that every business unit has to accomplish – raising social and environmental standards in the SC, improving the energy efficiency of the operations and products to reduce carbon emissions and promoting the renewable usage and recycling of products. At 2009 they created a system of 70 auditors who regularly check 200 plants owned by 150 key HP suppliers – more auditors than any other EICC (Electronic Industry Citizenship Coalition) member (Lowitt & Grimsley, 2009, p.13). HP sees sustainability as a competitive advantage.

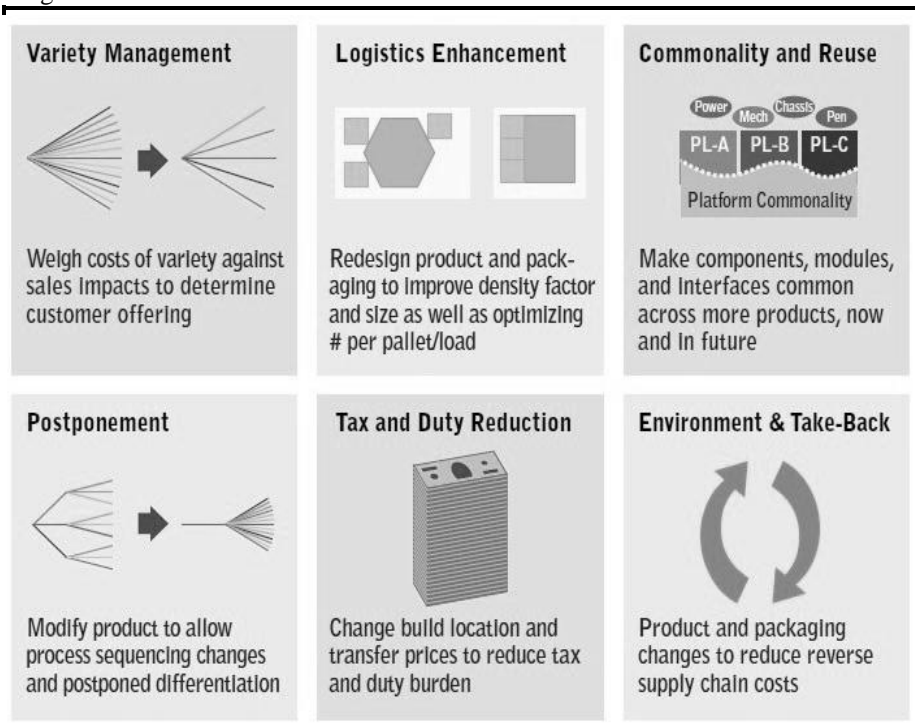
For the first time in the IT industry, HP published a complete carbon footprint report, as an impact a corporation is making on the environment – footprint of the extended SC of their operations, products and services. Based on HP report for 2012, from 79.609 million tons of carbon dioxide, their products and solutions emission are responsible for 60%, HP operations for 4% and SC for 36%. Reuse units reached 3,9 million units, and 133.550 tons of material was recycled (hardware and cartridges). Although in the total world carbon emission IT industry contributes with 2% only (Mingay, 2007, p.3), HP wants to reduce that, but also works to reduce the remaining 98% through the creation of new solutions for the market. For instance, a completely new category of commercial servers, launched in 2012, revolutionizes data centers, which compared to traditional servers consume 89% less energy, take to 80% less space, at 77% lower price, and are 97% less complex.

HP believes that IT has the opportunity to become a significant part of the energy efficiency solution, reducing the usage of raw material and replacing high-carbon with low-carbon emission processes. The elimination of personal printers and print jobs from desktops to centralized, cheaper and more efficient printing (printing outsourcing) is great example of that.

Faced with SC efficiency and effectiveness issues, HP has been analyzing the effect of sales channels to the decision-making process for more than 10 years. The result was the Design for Supply Chain program (DfSC), systematic, repeatable and wide accepted collaborations between developers and thousands of engineers within the company. Unique set of technologies, methods, training and infrastructure have been implemented to ensure fast and efficient decision making. DfSC enables making important decisions related to the SC partners, including suppliers, production and logistics partners, dealers, retailers and end-users. It also has an impact on the decisions over the entire product life cycle. It has been accepted that SC has to be included into new products designs. HP uses the portfolio of Six-Pack DfSC techniques to reduce SC costs, improve customer satisfaction, increase profit and SER. Standardization and consolidation of the processes throughout the company have enabled HP to provide the right product in the right place at the right time.

The following figure illustrates HP's Six-Pack DfSC.

Figure 2 HP's Six-Pack DfSC



Source: Cargille & Fry, 2006, p. 38

Reducing SC scale and complexity by decreasing the number of tools and processes is used on daily basis. The number of tools was reduced from 325 to less than 60, while the number of processes decreased from 1047 to less than 90 (Figure 3).

Figure 3 HP SC – scale and complexity



Source: Bakker, 2011, p. 26

## 5. LATEST EXAMPLES OF HEWLETT-PACKARD'S SUPPLY CHAIN SUSTAINABLE DEVELOPMENT

HP implemented a holistic approach to supply chain management (SCM), and to SSCM, also. End-to-end design, from production to customer, requires many activities – high cooperation, partner relationships, presence of many companies and SC response rates increasing. SC optimizations consist of a large number of smaller and bigger steps, while progress in performance happens slowly. Several recent examples of SCM optimizations, which have significant positive influence on the environmental protection and at company's long-term profitability will be presented.

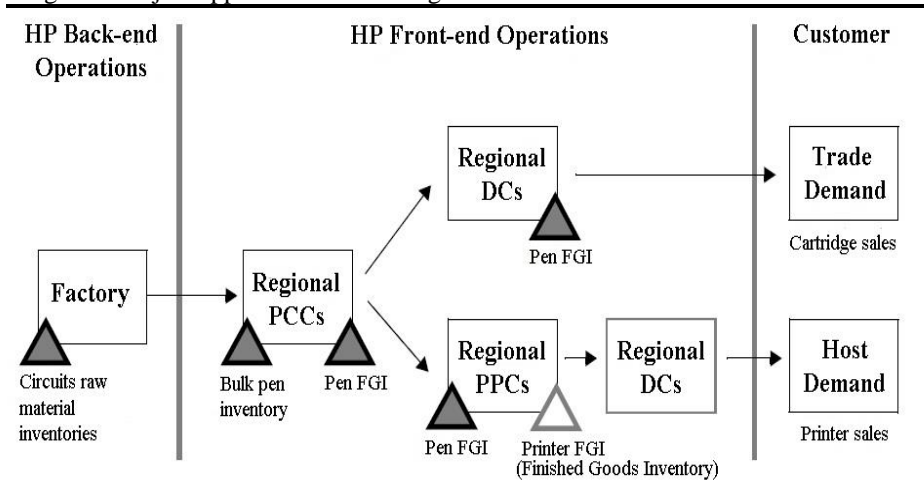
**Inkjet supplies - global optimization.** HP introduced inkjet technology in 1984 and they never seized being the world leader in this area. Printing supplies are produced and distributed through several sales channels. There are over 250 different types of cartridges (they have significantly longer life cycles, installed base is measured in hundreds of millions), in fifteen production families.

HP SC supports two types of requirements – consumers who already have printers and new sales. Before HP decided to optimize inkjet supplies, the largest cartridges inventory was in bulk. HP's factories shipped cartridges to regional centers for localization and re-packing. These regional centers shipped finished goods to the partners in sales channels, as well as to a large number of HP distribution centers, and HP factories, where they were put into new printers.

In order to optimize SC, HP implemented the vertical integration into Inkjet Supplies business. HP's back-end operations ship bulk pens (inkjet cartridges) to regional pen completion centers (PCCs). After the PCCs localize and package the pens, they ship finished products in two streams. Replacement supplies (trade demand) for previously purchased printers go to regional distribution centers (DCs)

and channel partners. Cartridges to be bundled with new printers (host demand) go to regional printer postponement centers (PPCs), which ship the bundled printer-cartridge products to regional DCs. Inkjet supplies optimization was done globally, taking into account the expected overall result.

Figure 4 Inkjet supplies – vertical integration



Source: Billington et al. 2004, p. 64

It increased HP raw material inventory in the factories and brought finished goods closer to the end-users. Global model reduced total worldwide stock and costs, and more than 90% of cartridges being transported over the ocean (Billington et al., 2004, p. 68).

**„Silky Road“.** Using the economic incentives offered by the Chinese government, in 2010 HP developed manufacturing and infrastructure in the provinces at the west of China, which improved working conditions for tens of thousands of employees in Chongqing. In order to provide fast, cheap and socially responsible products supply, HP developed transcontinental railway route (passing through 6 countries – China, Kazakhstan, Russia, Belarus, Poland and Germany) which was set in 2012. Thousands of HP notebooks and monitors are transported through contemporary „Silky Road, more than 10.000 km long. It reduces costs and delivery times, but also has significant benefits for the environment (railway vs. air transport) and employees (providing jobs in the west of China).

**Port of Piraeus – a new hub to improve the efficiency of the supply chain.** Every minute of every day HP delivers 120 personal computers, 100 printers and 1200 ink or toner cartridges (Prophet, 2013). Having reduced the number of suppliers by almost 50% and transit hubs by 25% (to around 1.000 manufacturing suppliers and 410 hubs) and having opened the transit hub in the port of Piraeus, Greece, HP has gained access to the markets of Europe, Africa, the Middle East and central Asia in a faster, more efficient way and with less impact on the environment. Improved access to the markets (Piraeus port is strategically located at the center of the Mediterranean), fast delivery (product delivery time reduced by 7 days), reduced



costs and the protection of the environment (ship delivery reduces carbon dioxide emissions by almost 57 times compared to air transport) are the results of innovation example implemented by HP into their SC.

**HP near-shoring – the latest experience from Serbia.** HP has invested significant resources into printing outsourcing, including regional optimizations solutions. Since the required printing level and quality is different from one region to another, HP has identified Serbia as a regional center for this business process (classic near-shoring). Basic version of the printer, with a maximized paper tray (up to 5.000 sheets), will be assembled by local partners to the final version, and the new product will be available in this region only. Near-shoring approach meets customer requirements best way – by adjusting quality and price and involving local partners.

## 5. CONCLUSION

Procurement, production, packaging, transport, storage, re-packing, delivery and returns of recycling IT products significantly affect the environment. That is the reason behind many of the initiatives for the sustainable SC (greening). Green products are more and more present in the market.

The largest brands compress each segment of their SC without “touching” the products at every level. The awareness of the need for establishing SSCM has led to numerous activities, usually in small steps, which classify the IT industry as one of the greenest.

Due to the importance of IT in every company, the methods and techniques developed by the IT companies are widely accepted. More and more companies have recognized the significance of cooperation and collaboration. The best IT companies deliver knowledge through entire of their own SC, improve response to the market, and make the sustainable development possible.

Social and environmental responsibility concern leads to changes in the SC that have a positive influence on all business aspects, including profit. Analyzing some specific changes in the HP's SC, in this paper we have shown how IT industry is getting „greener“, as well as SER contributes to the company profitability long-term.

## 6. REFERENCES AND SOURCES OF INFORMATION

1. Bakker, M. (2011). *HP's Global Supply Chain Optimization*, [available at: [https://supply-chain.org/f/M\\_Bakker\\_SCC\\_SupplyChainWorld\\_v1.pdf](https://supply-chain.org/f/M_Bakker_SCC_SupplyChainWorld_v1.pdf), access February 11, 2014]
2. Billington, C., Callioni, G., Crane, B., Ruark, J., Willems, S. (2004). Accelerating the Profitability of Hewlett-Packard's Supply Chains, *Interfaces*, Vol. 34, No. 1, p. 59–72.
3. Blackhurst, J., Cantor, D., O'Donnell, M. (2012). *Sustainable Supply Chains: A Guide for Small- to Medium-sized Manufacturers*, [available at: [http://www.ciras.iastate.edu/publications/CIRAS\\_Supply\\_Chain\\_Sustainability-2012.02.29.pdf](http://www.ciras.iastate.edu/publications/CIRAS_Supply_Chain_Sustainability-2012.02.29.pdf), access February 2, 2014]



4. Cargille, B. & Fry, C. (2006). Design for Supply Chain - Spreading the Word Across HP, *Supply Chain Management Review*, Vol. 10, No. 5, p. 34-41.
5. Carter, C.R. & Rogers, D.S. (2008). A framework of sustainable supply chain management: moving toward new theory, *International Journal of Physical Distribution & Logistics Management*, Vol. 38, No. 5, p. 360-387.
6. Ellis, S., (2013). *Change in the (Supply) Chain: High-Tech Global Supply Chains: Shifting Gears* [available at: <http://ct.org/wp-content/uploads/2013/11/2013ChangeintheSupplyChainWhitePaper.pdf>, access February 12, 2014]
7. HP Global Citizenship summary report (2012). [available at: <http://www8.hp.com/us/en/hp-information/global-citizenship/reporting.html>, access February 12, 2014]
8. HP Next Team (2013). *Modern-Day Silk Road Optimizes HP's Supply Chain*, [available at: <http://www8.hp.com/hpnext/posts/modern-day-silk-road-optimizes-hp-s-supply-chain#.U-U9Izitejw>, access February 15, 2014]
9. Lowitt, E.M & Grimsley, J. (2009). *Hewlett-Packard: Sustainability as a Competitive Advantage*, [available at: <http://www.hp.com/hpinfo/globalcitizenship/environment/commitment/accenturestudy.pdf>, access February 10, 2014]
10. Mingay, S. (2007). *Green IT: The New Industry Shockwave*, [available at: [http://www.ictliteracy.info/rf.pdf/Gartner\\_on\\_Green\\_IT.pdf](http://www.ictliteracy.info/rf.pdf/Gartner_on_Green_IT.pdf), access March 3, 2014]
11. Mejías, A.M. & Pardo, J.E. (2013). Best Practices in Sustainable Supply Chain Management: A Literature Review, *7th International Conference on Industrial Engineering and Industrial Management: Industrial Engineering and Complexity Management*, Universidad de Valladolid, Valladolid, 10-12th July, p. 59-66.
12. Prophet, T. (2013). *Investing in Transportation to Improve Supply Chain Efficiency at HP*, [available at: <http://www8.hp.com/hpnext/posts/investing-transportation-improve-supply-chain-efficiency-hp#.U-U-ezitejw>, access February 13, 2014]
13. Seuring, S. & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management, *Journal of Cleaner Production*, Vol. 16, Issue 15, p. 1699-1710.
14. WCED (World Commission on Environment and Development). (1987). *Our common future* [available at: [http://conspect.nl/pdf/Our\\_Common\\_Future-Brundtland\\_Report\\_1987.pdf](http://conspect.nl/pdf/Our_Common_Future-Brundtland_Report_1987.pdf), access February 15, 2014]



## **SUPPLY CHAIN MANAGEMENT IN THE CONDITIONS OF GLOBAL ELECTRONIC MARKET**

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*Scientific paper*

### ***Abstract***

Globalization today is one of the most significant changes in the environment. Global electronic market has characteristics of a free market and free participants in the supply chain. Strategic concept of the inter-organizational management in the global electronic market is conditioned by the technological innovations in supply chains. The participants of the supply chain internationalize their views on the global and electronic markets with the use of modern information technology. Information technologies contribute to the integration of the world economy and bring many benefits to management of supply chains. All this have the influence to the technological basis creation of the particular cultural integration in supply chains in the global market.

**Key words:** management, globalization, supply chains, electronic market

### **1. INTRODUCTION**

Globalization today is one of the most important changes that have a major impact on the relationship between participants on the market. Today's world is

becoming global market in which comes to the fore the interdependence of individual participants in supply chains. The participants in the supply chain internationalize their views on the global and electronic markets with the use of modern information technology. In order to define better supply chain management in terms of global electronic market, it is necessary to answer some of questions, such as:

- How the globalization of market influences the emergence of global supply chains?
- How to achieve supply chain efficiency in the global electronic market?
- What is the role of information technology in supply chain in the global electronic market?
- What are the specifics of supply chains of global electronic retailers?

Answers to these questions will provide solutions for supply chain management in terms of global electronic market. For this purpose it is necessary to start from the fact that the global electronic market corresponds to the global supply chain management, which suggests that access to on-line business needs to be global.

## **2. MARKET GLOBALIZATION AND INTERNACIONALIZATION OF SUPPLY CHAINS**

Globalization has a major impact on the expansion of contemporary supply chains. Internationalization of supply chains increases the number of participants in the supply chain, relationships between participants are becoming increasingly complex, and the main goal is to achieve global performance efficiency of the supply chain, which becomes increasingly difficult to achieve. Supply chain is a set of institutions that move goods from the point of production to the point of consumption (Dunne, et al., 2014, p.178) on the global market. Table 1 show some of the most efficient global supply chains, where it is noticeable that franchise systems have high efficient supply chains on the global market (such as McDonald's, The Coca-Cola Company, Starbucks, PepsiCo, H & M).

In terms of globalization, there is a change of the role of retailers in the internationalized supply chains. The retailer with the highest annual retail revenue in recent years is Wal-Mart, which operates in 28 markets (Deloitte, 2013, p. 11), and by the efficiency of the supply chain is in the thirteenth place. Special importance in the internationalization of retailer has efficient supply chain. The power and influence of retailers in marketing channels have been growing, so this trend follows three major developments: 1) increase in size and buying power; 2) application of advanced technologies, and 3) use of modern marketing strategies (Rosenbloom, 2013, p. 62). The position and role of global retailers become increasingly important in modern supply chains, bearing in mind that retail has direct contact with customers in different markets. With implementation of new marketing and management strategies retailers are positioning in the global market. To ensure the efficiency of the supply chain, retailers tend to equalize the way of business in all markets in terms of globalization and global competition. What is also recognized in the global supply chains is the power of global brands, which is reflected in the

efficiency of their supply chains (Apple, Unilever, P&G, Coca-Cola, Colgate, Nike, Pepsi, Nestle, Johnson & Johnson).

Table 1 Supply Chain Top 25 for 2013

Rank	Company	Peer Opinion 25%	Gartner Opinion 25%	Three-Year Weighted ROA 25%	Inventory Turns 15%	Three-Year Weighted Revenue Growth 10%	Composite Score
1	<b>Apple</b>	3,203	470	22.30%	82.7	52.50%	9.51
2	McDonald's	1,197	353	15.80%	147.5	5.90%	5.87
3	<b>Amazon.com</b>	3,115	475	1.90%	9.3	33.60%	5.86
4	Unilever	1,469	522	10.50%	6.5	9.00%	5.04
6	P&G	1,901	493	8.60%	5.8	3.60%	4.91
9	The Coca-Cola Com	1,779	278	11.70%	5.5	14.00%	4.33
10	Colgate Palmolive	794	324	18.90%	5.2	3.60%	4.27
13	<b>Wal-Mart Stores</b>	1,629	282	8.80%	8.1	4.90%	3.79
14	Nike	955	236	14.10%	4.2	10.60%	3.62
15	Starbucks	808	159	16.50%	4.8	11.50%	3.41
16	PepsiCo	810	314	8.60%	7.8	10.50%	3.41
17	H&M	399	41	28.20%	3.7	6.70%	3.22
18	Caterpillar	714	247	5.80%	2.8	23.40%	2.91
21	Nestlé	679	112	13.30%	5.1	-0.60%	2.51
25	Johnson & Johnson	730	144	9.60%	2.9	3.30%	2.35

Source: (Gartner, May 2013)

There also need to be considered the position of Amazon.com that occurs in the electronic market and provides its customers high reliability of delivery of the product regardless of consumers' location. Amazon.com, as a "click" electronic retailer, is on the list of largest retail companies in the global market, and in recent years recorded the highest growth in retail revenue compared to all retail companies in the world. Electronic retailing is characterized by the presentation of offers on a virtual market that is available globally and to everyone, regardless of location, but the development and efficiency of the supply chain is limited to the country where a particular electronic retailer delivers products. The most efficient supply chain in the global market and one of the most successful global companies is Apple, Inc., which owes its success to the efficient global supply chain by building its marketing channel at eleven world markets (Deloitte, 2013, p. 13).

Figure 1 Supply Chain Model of Apple Inc



Source: Available at: <http://www.supplychainopz.com>

A model of the supply chain of Apple Inc. was created under the influence of diverse Apple marketing channels, a large number of products, as well as the constant emergence of new innovative products in the supply chain. Apple sells its products through various marketing channels, offering products in its retail stores, through direct sales, as well as through e-retailing. As it is showed in Figure 1 the purpose of electronic retailing and its efficiency Apple performs particularly through storing and delivering by the FedEx, while in case of the retail stores, direct sales, and other types of sales, storing is performed in different storage.

The functioning of the global supply chain involves the effective integration of all participants in the supply chain which is an extremely difficult task. The global market involves complex relationships between participants. Participants are usually found in various countries, product that is necessary to deliver to customers is sometimes in another, and consumer is in third country. Therefore, it is crucial finding the optimal supply chain that will be effective and deliver the product to the end user regardless of where it is located. The existence on the global electronic market provides consumers with the opportunity to purchase products that they cannot find at the local market, and for the realization of such a purchase is necessary an efficient and accessible supply chain.

### 3. DEVELOPMENT OF ADVANCED INFORMATION TECHNOLOGIES ON THE ELECTRONIC MARKET

An e-marketplace is a virtual market in which sellers and buyers meet and conduct different types of transactions (Turban, et al., 2012, p. 85). The development of modern information technology in the electronic market is conditioned by technological developments and activities of the participants in the supply chain. Intermediary efficiency is disappearing through the time and local function because of distance elimination, time homogenization and location unimportance (Končar, 2008, p. 41).

Modern business through the supply chain, thanks to the new power of interactivity, has the ability of better differentiation of products and services through the rapid flow of information and the development of modern information technology. Technology is changing the nature of retailer-customer and retailer-supplier interactions (Berman, et al., 2013. p. 71).

Technological innovation in the supply chain ensures the efficiency of information exchange. Smooth flow of information through the supply chain requires a unique data exchange between all participants in the supply chain, all the way to the end consumer. Thanks to the standardization of data exchange more efficient delivery of products through the supply chain is provided, together with inventory tracking, increasing the efficiency of distribution and transportation of products in the supply chain and safe delivery of products to the consumer at the global level.

Participants in the supply chain use different forms of wireless connectivity and data exchange, where technology is developing in the field of hardware and software for data management. Particular importance is given to mobile applications, as the mobile, PDAs and smart phones are becoming in mass usage by consumers. With the development of e-commerce and implementation of global supply chain, mobile commerce is developing, which is becoming increasingly attractive way of ordering products by consumers in the global electronic market.

Also global supply chains leads to the development of technologies for the purpose of locating products in the supply chain. One of the innovative technologies used in the global supply chains is RFID (radio frequency identification). Thanks to RFID, products are tracked through the supply chain, regardless where the production and products are, in storage or in transport, and gives accurate information about where the products were previously. The application of RFID technology in supply chains is standardized so that is applied globally, regardless in which country each individual participant of the supply chain has its operations. Providing accurate information about the product and its location, RFID technology is applied in order to increase supply chain efficiency and customer satisfaction, taking into account the privacy and consumers' data protection. Further development of the technology in the supply chain will go towards increasing the speed of data exchange, greater standardization and protection of consumers' data and data of other participants in the supply chain.

#### **4. CONCEPT OF INTER-ORGANIZATIONAL MANAGEMENT IN CONDITIONS OF GLOBALIZATION OF ELEKTRONIC RETAILING**

Supply chain management in the global market requires adequate inter-organizational management. At the global electronic market, in addition to electronic retailers "clicks", perform also retailers which have a retail network ("bricks and clicks"), and usually their operations are based on internationalization. Differences between these retailers are noticeable in the supply chain and the concept of inter-organizational management. Hence, Amazon.com as the largest electronic retailer, with the highest increase in annual revenue compared to all retailers (both electronic and traditional), has a specific supply chain since it operates in a global market and

has a number of local websites, while traditional retailers, such as Tesco in Europe and Wal-Mart in the U.S., adapt their electronic retailing to already existing supply chain.

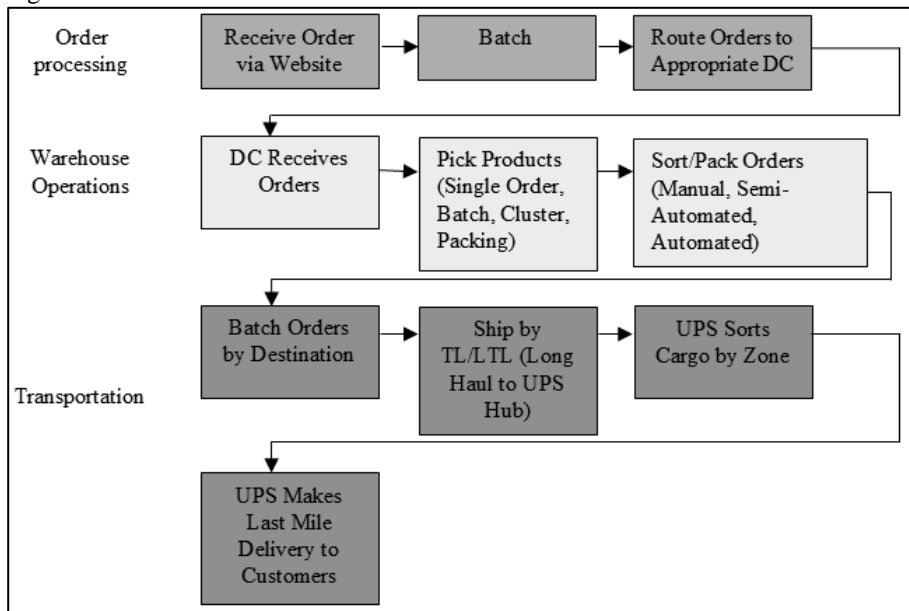
Amazon's global strategy is to offer products at low prices, wide and deep range of products and reliability. What is crucial for the efficiency of the supply chain of electronic retailer is the location of its distribution centre. Amazon.com determines the location of its distribution centres in line with the costs that are influenced by the distance of customers, or legislative requirements of each individual country in terms of taxes and fees, levels of salaries, etc. A large number of products, offered at several local websites, make Amazon's supply chain and inter-organizational management complex, but necessarily integrated in the global market. Amazon.com on its website has products that are autonomously delivered to the end customer, and provides a range of products of other suppliers, with a role of electronic broker, while delivery of ordered product leaves to the supplier.

In Figure 2 is showed the structure of ordering process and implementation of the ordered products in Amazon's supply chain in a situation where the product delivers Amazon.com. Inter-organizational management activities are divided into groups of ordering, warehousing and transportation operations. Products that are in Amazon.com distributive centres are sorted according to frequency of ordering and the intensity of demand of certain product. Products that are usually bought on the website, independently of seasonal fluctuations in demand, such as books, magazines, CD and DVD are in a separate section, because it is extremely important to have effectiveness in delivery of products that have great demand. These products are important to have always in stock, so that inventory level is always known and ready for quick response, in order to require on time new quantities from suppliers. Modern information technologies, used by Amazon.com in the supply chain, provide adequate inventory tracking, movement in demand and forecasting changes in demand. Amazon.com has the ability to adequately predict changes in demand and adjust its business activities.

Transportation of ordered products, depending on where it is necessary to carry out the delivery, is done in the most possible economical way, by summing up the ordered product in a particular territory, then deliver to each individual customer, which sometimes is not as easy, since the most important thing is customers' satisfaction and putting products available to consumers in the shortest possible time.



Figure 2 Amazon's Order-to-Cash Process



Source: Available at: <http://www.supplychainopz.com>

When it comes to global retailers, which implement electronic retailing in existing marketing channels, there are certain characteristics of supply chains in global electronic market. Traditional retailers, by relying on their existing retail network, have a choice of several multi-channel strategies, which are (Laudan & Traver, 2012, p.736):

- 1) *on-line order, in-store pickup* – where consumers find offers on the website, order products and take products to the nearest retail store, without wasting time on shopping in store;
- 2) *online order, store directory and inventory*;
- 3) *in-store kiosk, Web order home delivery* – consumer goes in the store but do not waste time in shopping, so shopping is done in electronic kiosk, and the products are shipped to home address;
- 4) *in-store retail clerk, Web order, home delivery* – ordering performs certain sales staff on orders of customer, and products are delivered to home address;
- 5) *web order, in-store returns, and adjustments* – ordering products via the web, and going to the retail store for the purpose of changing or adapting products;
- 6) *online Web catalogue* – complete electronic purchase and delivery of products, with view to the whole range of products;
- 7) *manufacturers use online Web site promotions to drive customers to their distributors' retail stores*;
- 8) *gift card, loyalty program points can be used in any channel*.

Tesco is one of the first retailers which have introduced electronic retailing for foods and consumer products. As one of the biggest European retailers, Tesco is the

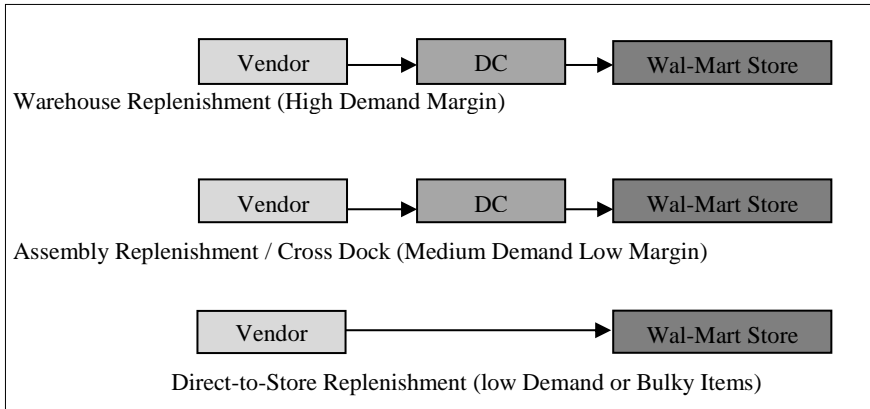
second in retail revenue and has a retail network in thirteen countries (Deloitte, 2013, p. 11). In the electronic retailing of consumer products is of great importance to ensure the freshness of the product when the product reaches the consumer, or until the consumer is using it. Electronic retailer Tesco relies on its retail network, such as identifying location of consumer and shipping product from the nearest Tesco's store. For Tesco, retail store is also distribution centre for consumer products, while sales of most non-food items, such as books and discs, are made from specialized distribution centres. Location of the customer is automatically determined, so consumers can choose goods that are available in their nearest Tesco store. Given the fact that delivery is performed around the world, the number of products are limited because orders placed online are automatically redirected to a retail store located on the shortest distance from the consumer. When the target retail store receives an order, employees of Tesco automatically find the location of the requested products on the shelves in the store, collect them and scan. After all items are collected, they are stored in temporary storage, then commissioned and placed in special trucks that ordered products deliver to consumers' home. For the transportation of food products are used trucks with separate compartments for different temperature storage.

For the efficient exchange of information, that is crucial in this specific electronic retailing, is necessary efficient inter-organizational management, information system, a system for data processing and data mining techniques, which aim to link all retail stores with electronic retailing. Tesco's efficiency of the supply chain is reflected in the fact that the number of its customers increased in the global electronic market. Individual purchases of consumers who buy online in Tesco electronic stores are much higher than in traditional stores, and by this the performance on the electronic market. Many consumers who have never visited a Tesco retail store began to buy electrically, also the presence on the global electronic market increased retail revenue in stores, and the fact is that Tesco is among the leading retail companies year after year shows the success of its multi-channel strategy.

Wal-Mart is the largest retailer in the world by retail revenue and its success is based on the efficiency of the supply chain, as it is evident by its ranking among the most efficient supply chains. Inter-organizational management in the Wal-Mart's supply chain provides effective coordination between all participants in its supply chain. Suppliers of Wal-Mart ensure availability of the products in stores. Wal-Mart is a retailer that is characterized with high consumers' loyalty and trust, as well as reliability. Regardless of the manner in which the consumer completes its purchase, the product will be available to consumers. In the case of Wal-Mart the process of delivery of the product is carried out based on the intensity of demand, as well as in the case of Amazon.com. A key component of Wal-Mart's supply chain is distribution centres located in different markets. When it comes to the location of the distribution centre, Wal-Mart takes care of the structure and position of the retail network and demand for products. Figure 3 shows three models. The concept of warehouse replenishment Wal-Mart uses for products that have high demand. Assembly replenishment/cross dock concept of inter-organizational management is used for products that have a medium volume of demand, while the

concept of direct-to-store replication is used for products with low demand and bulky products.

Figure 3 Wal-Mart Replenishment Process



Source: Available at: <http://www.supplychainopz.com>

Depending on the frequency of demand of products that are available in electronic stores, Wal-Mart carries realization of ordered products from its distribution centre or directly contacts the supplier. Electronic marketing channel becomes a way of positioning retailers and building loyalty. In doing so, thanks to the electronic ordering a product, the consumer is no longer unknown, but it is possible to identify and personally contact each individual consumer. In this way, the consumer becomes a distinctive and active participant in the supply chain. Individual consumers can be approached on an individual basis, offered a personalized offer, and all with delivery of the product to the consumers' home. Approach "face-to-face" can be an effective approach to the consumer, creating an offer in accordance with the requirements and adequately and promptly respond to claims, and by that predicting future demand. Building long-term relationships with customers should be the basis for building long-term relationship with all participants in the supply chain in the global electronic market.

## 5. CONCEPT OF SUPPLY CHAIN MANAGEMENT IN THE CONDITIONS OF GLOBAL ELECTRONIC MARKET IN REPUBLIC SERBIA

Electronic market in Republic Serbia is developing from year to year, influenced by the increasing adoption of this method of purchasing products by customers. Chances in the electronic marketing channel in the Serbian market are recognized by retailers with a developed retail network, as well as by new businesses that base their strategy only on the electronic channel. Therefore, we can say that on the electronic market in Serbia exists electronic retailers "clicks" and "clicks and bricks". Depending on the type of the electronic retailing, retailers are creating and operating their supply chain.

Companies engaged primarily in electronic sales need to be registered for this activity, and strategies of “click” electronic retailers have 98 registered entities in Serbia, according to data from 2011 (Agencija za privredne registre, available at: <http://www.apr.gov.rs/>). These electronic retailers offer a variety of products from technical equipment, to baby accessories, cosmetic products, toys, etc. Electronic retailers in the electronic market in Republic Serbia deliver products to the customers’ home, with different options to pay for the product (electronic payment cards, payment on delivery, etc.). But there is a problem in the implementation of the ordered products, considering that most electronic retailers don’t have integrated system of monitoring stocks with the ordering process, and often products on the website are not really available, which leads to customer dissatisfaction during the purchasing process. In addition, retailers with a retail network are extending their supply chain by delivering products to customers from their retail stores, and retailers participating only electronically have a shorter supply chain.

What is the limitation for the development of global electronic market, in which Serbia would be involved, is limited payment system of products that have been ordered by customers from abroad. With the implementation of the PayPal payment system in the electronic market there is possibility for electronic payments of the ordered products from abroad, but it has not yet easier of purchasing and paying products of domestic suppliers in the global electronic market.

Successful participation in the electronic market in Serbia has retailers with retail network and distinctive name in which customers trust. The most common are electronic retailers “click and brick” that sell electronic equipment and appliances connected to the computer, baby equipment, toys, products for home, garden and tools, and so on.

In recent years, electronic sales of goods of daily consumption is evolving by retail chains such as “Univerexport” (“Elakolije”, [www.univerexport.co.rs](http://www.univerexport.co.rs)), “Idea” ([online.idea.rs](http://online.idea.rs)), “Maxi” ([shop.max.rs](http://shop.max.rs)), and it is in preparation by “Mercator” in Serbia (already successfully represented in Slovenia with the concept “click and collect”). For daily consumer products, there are a number of specific features of the supply chain, and the introduction of electronic channels is necessary to ensure reliability and efficiency in the delivery of the product to the customer.

One of the most successful concepts of electronic hypermarkets in Serbia is “Elakolije”, offering over 10,000 items in the product group of goods of daily consumption, that on the performance of functions related to the operation of the electronic store have employed 50 people, and the delivery of ordered goods is done at the same day within two years of operation, this electronic store generated 100,000 sales with the limit values of individual purchase orders (not less than 1,500 dinars), which is higher than the average value of individual purchases in the store of this retail chain (available at: <http://www.univerexport.co.rs/online.php>). Delivering of products from this website is available only in major cities in Serbia, where this retailer has its own larger format stores, like Belgrade, Novi Sad, Vrsac and Subotica. Preparation of ordered products is made immediately via mobile applications, from which is taken account for commissioning, then the list of products that are ordered with exact information are checked, and after control the product is sent to the home of the customer. As the products are often perishable and

require special conditions during transport and handling in delivery, quality and freshness of the product is provided in the vehicles according to the HACCP standards, in special refrigerated chambers taking into account the fact that the ordered products require different treatment on delivery. The process of preparing goods for delivery is carried out after half an hour and most orders are received in the late afternoon and evening, mostly on weekends, when there are the largest crowds in the hypermarkets, and it is necessary to do the weekly shopping in greater value.

Figure 4 Availability of delivery of ordered products over the Internet and road network in Republic Serbia



Following retailer that has implemented an electronic store of consumers good is "Idea". Delivery of products purchased on this electronic store is made at the time that consumer determines. For the purpose of delivering products to the customer's home company uses its vehicles, only in the territory of Belgrade and certain parts of the city, and the service is free for an amount higher than 3,500 dinars, although the delivery services is not available 24 hours, but only up to 21 p.m., while in the weekends service is limited to 15h (available at: [www.idea.rs](http://www.idea.rs)). Also, ordered

products from this electronic store are shipped the next day or a few days in advance if consumer determines that.

Third retailer of goods of daily consumption that has an electronic sale is "Maxi". The opportunity to purchase in this online electronic store is available to consumers in Belgrade (in certain municipalities), Novi Sad and Nis (and to a distance of 20km from store) (available at: <http://shop.maxi.rs/maxi-online-76-uslovi-kupovine>). Delivery of ordered goods is done on the same day if the order is carried out to 12 p.m. The order is confirmed by calling customer, who needs to certify the goods order, and to determine the exact time when he wants the goods to be delivered.

When we talk about products which are easier to delivery to consumer than the consumers goods, in Serbia are most often ordered and delivered clothing, IT equipment, household appliances, kitchen appliances, devices for video surveillance, watches, jewellery, toys, health supplements etc. "WinWin" Computer Shop sells products from these groups, and has its retail network in Bosnia and Herzegovina, Montenegro and Serbia, which allows operation on the electronic market in these countries. With the widespread retail network of stores in Serbia, "WinWin" offers an electronic shopping and delivery on the same day with the option to pay cash on delivery, and delivery services is free for the amount of goods exceeding 5,000 dinars (available at: <http://www.winwin.rs/rokovi-ispоруke.html>). This service is available to customers in Belgrade, while for customers from other cities delivers purchased products through the involvement of an intermediary. In this group of products, as is the case with the product groups that require similar treatment in the delivery of products, supply chain is similar with minor variations in some electronic retailers.

## 6. CONCLUSION

The expansion of contemporary supply chains is increasingly influenced by contemporary global trends. Internationalization of supply chains increases the number of participants in the supply chain, and as a consequence the relations between the parties have become more complex, so it is more difficult to achieve the efficiency of the global supply chain. The position and role of global retailers in modern supply chains is gaining increasing importance as a growing number of retailers have development strategy based on the internationalization of business. To position themselves in relation to global competition, global retailers implement new marketing and management strategies. For the efficiency of the supply chain of great importance is finding the optimal supply chain that will be effective and deliver the product to the end user regardless of where it is located. Further development of the technology in the supply chain will go towards increasing the speed of communications and data availability, greater standardization and protection of consumers and other participants in the supply chain. Global electronic market is characterized by "clicks" electronic retailers and retailers that have their retail network. Amazon.com on its website has products that autonomously deliver to the end customer, and provides a range of products of other suppliers. Depending on the

relationship with suppliers, Amazon.com creates its supply chain in the electronic market. Electronic market in Serbia is being developed under the influence of the increasing adoption of this method of purchasing products by customers and retailers. The most common are electronic retailers "click and brick" that sell electronic equipment and appliances connected to the computer, baby equipment, toys, and in recent years is developing electronic retailing of consumer products. Retailers in Serbia still have higher costs in the supply chain by implementing electronic retailing, but electronic retailing has positive impact on business on traditional grounds.

## 7. REFERENCES AND SOURCES OF INFORMATION

1. Agencija za privredne registre Republike Srbije, available at: <http://www.apr.gov.rs/>, access: June 1, 2014
2. Berman, B., Evans, J.R. (2013.) Retail Management, A Strategic Approach, Pearson Education Limited.
3. Deloitte (2014). Global Powers of Retailing 2014. London, January 2014.
4. Dunne, P.M., Lusch, R. F., Carver, J. R.(2014). Retailing, South-Western, Cengage Learning.
5. Končar, J. (2008). Strategic Supply Chain Management Under Conditions of the Global and Electronic Market, Strategic Management, International Journal of Strategic Management and Decision Support Systems in Strategic Management, 4/2008. p. 41.
6. Laudan, K. C., Traver, C. G. (2012). E-Commerce 2012. Business. Technology. Society, Pearson, Essex.
7. Rosenbloom, B. (2013.) Marketing Channels, A Management View, South-Western.
8. Turban, E., King, D., Lee, J., Liang, T-P., Turban, D. (2012). Electronic Commerce 2012. A Managerial and Social Networks Perspective, Pearson.
9. Gartner, The Gartner Supply Chain Top 25 for 2013, May 2013, available at: <http://www.gartner.com/technology/supply-chain/top25.jsp>, access: June 1, 2014
10. Available at: <http://www.supplychainopz.com>, access: June 1, 2014
11. Available at: <http://www.winwin.rs/rokovi-isporuke.html>, access: June 14, 2014
12. Available at: <http://shop.maxi.rs/maxi-online-76-uslovi-kupovine>, access: June 1, 2014
13. Available at: <http://online.idea.rs/static/delivery>, access: June 1, 2014
14. Available at: <http://www.univerexport.co.rs/online.php>, access: June 1, 2014





## INFLUENCE OF AUTHORIZED ECONOMIC OPERATORS ON SUPPLY CHAIN SECURITY

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*Scientific paper*

### ***Abstract***

Supply chain security and logistics management in private and public sectors is dependent on accurate, comprehensive data from trusted, compliant companies. Among all involved in supply chain and logistics Customs plays an important role in the fight against cross-border crime and terrorism. Customs expertise in controlling goods, backed up by the use of modern IT systems with e-Customs tools, and an efficient risk assessment and border control management, is vital to detect illegal goods such as drugs, explosive materials, nuclear and chemical weapons.

One of the most important components of European Union's Community Customs Code is status of Authorized Economic Operator (AEO). Its aim is to grant economic operators the status of a low-risk, more trusted actor under certain circumstances when it comes to actions with customs authorities within the EU. At the moment there are three types of AEO status that companies can be certified for.

Since Croatia joined EU in 2013, Customs has started to apply concept of Authorized Economic Operator system. This process and status is relatively new and there are not many companies that have started process of receiving status of AEO that will give those companies benefits in customs procedures in EU and whole world. Therefore this paper will give more information about AEO status and what Croatian companies need for getting this status and how it can benefit supply chain security.

**Key words:** supply chain, security, security standards, authorized economic operator, benefits for companies, AEO in Croatia

### **1. INTRODUCTION**

Supply chain security has always been important issue for all included parties from sending, logistic and transport companies, customs authorities and finally to the receiving companies. Among them customs has a long tradition of controlling shipments. In the second part of 20<sup>th</sup> century, almost all goods have been inspected by customs authorities. Due to the significant increase of goods flow and globalization in trade customs can't control anymore all import. Customs role has changed and is now directed to use of modern methods of risk analyses and

subsequent controls, thus reducing the cost of meeting compliance requirements for legitimate trade.

One of the main tasks of all included stakeholders in today's supply chain security is to identify risk in flow of goods. Therefore it is necessary to manage risks, to know risks they are facing and their possible impact on the targets. The purpose of risk management is to focus control activities on risks and not on randomly selected aspects or import declarations. Customs authorities therefore have to assess company's processes, procedures, administration etc. in order to check the management of supply chain and potential risks. It is necessary to assess the administrative organization of the company and its internal control system.

The main task of this paper is to identify how the certain agreements and standards can influence supply chain security in today's global trade, what are similarities and differences between standards and how the company can apply and become certified in accordance to one of those standards – authorized economic operator. Paper is divided in several parts. In first part of paper we will present authorized economic operator standard will together with it legal basis and we will compare it with other security standards. In the second part of paper we will research how to become authorized economic operator in Croatia – how to apply, what are the steps to receive the status. In the last part we will present benefits that company can have from having AEO certificate in global trade conditions.

## **2. SUPPLY CHAIN SECURITY STANDARDS IN THE WORLD**

Today in the world there are many different standards that are used for transport and cargo security. Supply chain security became main issue especially after attack on the World Trade Center in New York. Terrorist attacks were not only reason so Closs & McGarrell (2004) stated three main factors for increased supply chain security. First is globalization of the world trade that depends and is mainly created from free flow of people, goods and information. Next is increased demand for efficient supply chain from business side. Finally the third is increased threat from different illegal and antagonistic threats. In the last several year it is seen that legal and regulatory environment has evolved and there is increased initiative for addressing need for increased security within supply chains in global trade. Today different intergovernmental and private organizations are the ones making and issuing these standards (Szelp, 2010).

One of the best known is World Customs Organization's (WCO) SAFE framework for supply chain security. Tweedle (2008, p.102) noted that main objective of SAFE is to *“secure and facilitate global trade through the establishment of cooperative arrangements between Customs, trade and other government agencies in order to promote the seamless movement of goods through secure international trade supply chains.”* SAFE framework was built upon revised Kyoto Convention where the customs was encouraged to look beyond their traditional role of gatekeeper and to become trade facilitator (Widdowson, 2007). For SAFE framework Peterson and Treat (2008, p. 4) concluded that it *has two customs oriented supports: the customs-to-customs network and the customs-to-*

*business partnership*. First network uses techniques for screening high risk cargo and second partnerships for setting procedures for certifying shippers. These two supports are helping business to realize primary concepts of framework: use of advance inbound and outbound cargo information; risk management; and installing new programs for commercial shippers (Boske, 2006). Peterson and Treat (2009) stated that many countries worldwide updated their cargo security programs. These programs among other include Transported Asset Protection Association (TAPA), Customs-Trade Partnership against Terrorism (C-TPAT) in USA and Authorised Economic Operator (AEO) regulation in European Union (Table 1).

Table 1 Main supply chain security programs worldwide

Program	Implement- ation year	Country of origin	Main objectives	Participants
Customs-Trade Partnership Against Terrorism (C-TPAT)	2002	USA	Security of cargo transported by land, air, and sea into the United States Supply chain security	Importers, manufacturers, transportation and logistics firms, customs brokers, warehouse and port terminal operators
WCO SAFE Framework	2005	Global	Customs/ trade facilitation Supply chain security	144 member countries as of February 2007
European Union's Authorized Economic Operator (AEO) program	2008	European Union	Customs/ trade facilitation Supply chain security	Importers, exporters, manufacturers, Customs brokers, Transportation firms of EU member-states
Frontline Program	1990	Australia	Cargo security, with a new focus on counterterrorism following 9/11	Shipping firms, Freight forwarders, airlines, customs brokers, warehousing firms, postal and port authorities
IMO International Ship and Port Facility (ISPS) Code	2004	Global	Maritime port security Cargo/supplychain security	National governments Maritime port Facility operators Shipping firms
U.S.-EU Mutual Assistance Agreement	2004	United States, European Union	Mutual recognition and Harmonization of customs procedures	Customs Administrations and port terminal operators in the USA and the EU

Source: adapted from Peterson, J. and Treat, A. (2009, p. 28-30)

Table 2 is showing different supply chain security protocols and programs that are currently operational worldwide. Most of them became operational after the terrorist attacks in USA. As previously stated different organizations and/or agencies have created and implemented different supply chain security standards, protocols and/or programs. Guiterez & Hintsa (2006, p. 3) identified four main types of them: *a) customs compliance programs to which the security layer has been added; b) government origin, pure security programs; b) international organization origin, security standards programs; and d) private origin, pure security programs.*

Table 2 Identified types of voluntary supply chain security programs

Type of program	Examples	Main motivation and philosophy
Customs compliance programs to which the security layer has been added	PIP (Canada), StairSec (Sweden), ACP & Frontline* (Australia), AEO (EU)	Customs administration aiming to streamline Customs processes (e.g. accounting, payment and clearance) for compliant importers/exporters. Due to new security concerns these programs have added a security layer. This implies that importers/exporters eligible for border crossing facilitation benefits should not only be Customs compliant but also low risk.
Government origin, pure security programs	C-TPAT(USA), Secured Export Partnership (New Zealand)	Governments and border agencies motivated by recent terrorist attacks. Security measures aiming to transfer some of the customs control responsibilities to importers/exporters, in order improve the capacity to detect illegal activities. These programs have become prerequisites for participating in other Customs compliance programs.
International organization origin, security standards programs	WCO framework of standards, ISO (International organization for standardization)	International organizations aiming to establish supply chain security standards that can be generalized for the entire trading community.
Private origin, pure security programs	BASC (Latin America), TAPA (technology companies)	Private companies exposed to high risk of suffering from illegal activities in their cargo management operations. Security measures targeting the protection of cargo from being tampered or removed illegally.

Source: adapted from Guiterez & Hintsa (2006, p. 3)

Previous table summarizes the main motivation and philosophy for different types and gives examples of the programs that belong to the different types of supply chain security programs. In the further part of paper we will examine one of the supply chain security programs - Authorized Economic Operator program that EU has started for their member countries.

### 3. AUTHORIZED ECONOMIC OPERATOR (AEO)

The European Commission introduced the Authorized Economic Operator (AEO) status for two reasons. One was as response to the need for greater security throughout international supply chains and second was as an answer USA decision

to introduction of Customs – Trade Partnership against Terrorism (C-TPAT). Every company that is transporting goods in and/or out of European Union (EU) and which in this process need to deal with Customs authorities can apply to become Authorized Economic Operator (AEO). If the company becomes recognized as AEO it means that it can demonstrate how reliable and secure customs related operations it has. Besides that it means that company will have easier access to simplified customs procedures (i.e. certified receiver, certified exporter, etc.).

Legal foundation and detailed provisions for starting of AEO certification in EU were brought in the amendment of Implementing Provisions of the Community Customs Code with Regulation 1875/2006. European Commission made these provisions based on pilot research that was conducted during 2006. Further European Commission Regulation No 1192/2008 aligned rules for granting both the AEO certificate for customs simplifications and the single authorization for simplified procedures (SASP). Being an AEO facilitates the process of achieving a single authorization for simplified procedures as the relevant criteria are deemed to be met. In 2010 European Commission brought Regulation No 197/2010 that has established new time limits for issuing the AEO certificate.

Based on European Customs code (Urcioli & Erwall 2009; EU, 2013) AEO certificate can be granted to any economic operator that is meeting several criteria: record of compliance with customs requirements; satisfactory system of managing commercial and, where appropriate, transport records, which allows appropriate customs controls; proven financial solvency and where appropriate, security and safety standards (Figure 1). Every company can based on the potential benefits and requirements decide which AEO certificate they would like to pursue.

Table 3 Requirements and benefits of AEO certifications

	Customs Compliance	Record keeping	Financial Solvency	Safety and security	Customs simplifications	Fewer inspections	Priority treatment	Choose place for control	Prior notification
AEOC	X	X	X		X	X	X	X	
AEOS				X		X	X	X	X
AEOF	X	X	X	X	X	X	X	X	X

Source: adapted from Urcioli & Erwall (2009, p. 844)

There are three AEO certificate types currently being awarded (EU, 2013; CURH, 2013):

- AEO Customs (AEOC) – certificate holder is entitled to easier admittance to customs simplifications; fewer physical and document-based customs controls than other economic operators, with the exception of those controls related to security and safety measures; priority treatment if selected for control and possibility to request a specific place for such control. Holder of AEOC is not entitled to any of the AEO benefits related to security and safety of the international supply chain.
- AEO Security and safety (AEOS) – certificate holder is entitled to possibility of prior notification when selected for control; reduced data set for entry and exit summary declarations; fewer physical and document-based controls in respect

of security and safety; priority treatment if selected for control and possibility to request a specific place for such control. The holder of an AEOS is recognized as an economic operator who has taken appropriate measures to secure his business and is thus a reliable actor in the international supply chain both from the perspective of the relevant government authorities and from the perspective of his business partners.

- AEO Customs Simplifications/Security and Safety (AEOF) – company is entitled to benefit from both simplifications provided for under the customs rules and from facilitations of customs controls relating to security and safety (a combination of 1 and 2).

Figure 1 End-to-end Supply chain



Source: author, 2014

Tweddle (2008) stated that the AEO is designed to increase the strength of the supply chain and border security by cooperation of the supply chain owners – exporters, importers, transporters, customs forwarders, warehouse operators and manufacturers (Figure 1). Every part of supply chain has its own importance for the supply chain and its security.

#### 4. AUTHORIZED ECONOMIC OPERATOR IN CROATIA

Although after Croatia entered EU there has not been significantly visible changes there were some less visible but for companies and economy in total significant ones. One of those is start of applying system of AEO for which Customs authorities are in charge. The AEO certificate is not obligatory for any company but it can be useful since with it Customs authorities guarantee reliability of the company and this gives certain benefits to the company. First applications for becoming AEO in Croatia have started in autumn 2013. Based on Customs authorities (CURH, 2014) until May 2014 around 25 companies have applied for AEO certificate and until now no certificate has been approved yet. Process of approving AEO certificate lasts at least 6 months so it is expected that first AEO certificates in Croatia will be awarded in June or July 2014.

##### 4.1. How to become AEO?

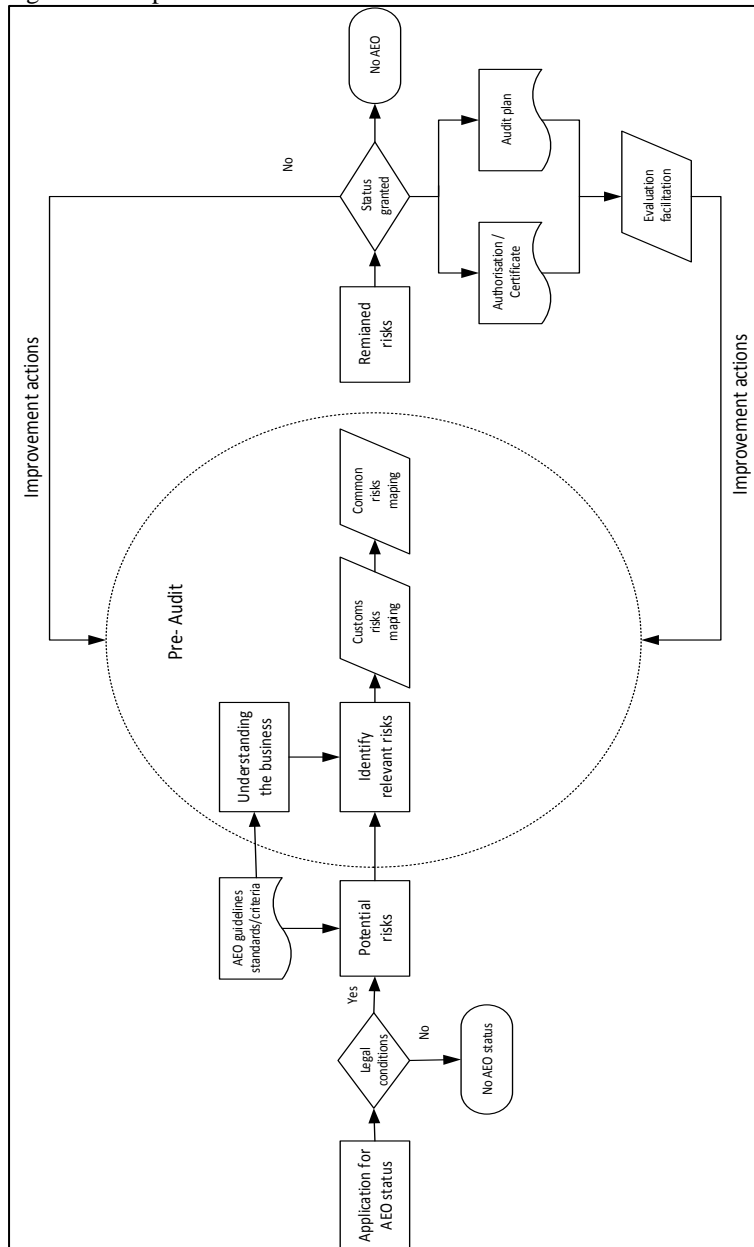
In order for company to receive AEO certificate in Croatia it is necessary to ensure appropriate records of compliance with customs requirements, as well as a satisfactory system of keeping business records and, if necessary, a record of the transports to allow appropriate customs controls. In addition it is necessary to have proof of financial ability, and if necessary, appropriate safety and security measures.

Every company applying for AEO certificate needs to fill self-assessment questionnaire with basic questions about all AEO criteria. This questionnaire is first step for every company and this helps company to see if they could / should apply for AEO. Questionnaire has 5 sections and it covers all business aspects of company from its organization, relation to customs and security and safety. Besides this document company should provide additional documents which will be used by Customs authorities in evaluation of their AEO application.

In order to evaluate company's application for AEO Customs authorities are using Compact model framework (Figure 2). Compact model framework is a *flexible tool that can be used not just in the protection of the fiscal interests of a Member State or the Community, but also in the protection of the non-fiscal interests such as the protection of the external frontier of the Community (e.g. Supply Chain Security and Anti-Smuggling)* (EC, 2006, p. 2). Important part of Compact model is risk analyses and mapping method and guidelines on criteria for approving AEO certificate and standards. Company which want to become AEO should implement systems, procedures and requirements that are in accordance to EU Customs code and guidelines on criteria and standards. While using Compact model and risk management Customs authorities assess measures that company has taken in order to prevent risks in their processes. Therefore customs has to assess business processes, organization, administration of the company that has applied to become AEO (Iordache, 2008). Risk mapping process consists from five steps (EC, 2006):

1. Need for understanding the business of company applicant,
2. Clarify the customs' objectives,
3. Identify risks (which risks might influence the customs' objectives),
4. Assess risks (which risks are the most significant),
5. Respond to risks; what to do about the (remaining) risks.

Figure 2 Compact model for AEO in Croatia



Source: adapted from European Commission (2006, p. 4)

In the process of risk mapping customs authorities usually divide the process in two parts by performing mapping internally and then with potential AEO. In the second part customs has to make decision where the risks are and what is the



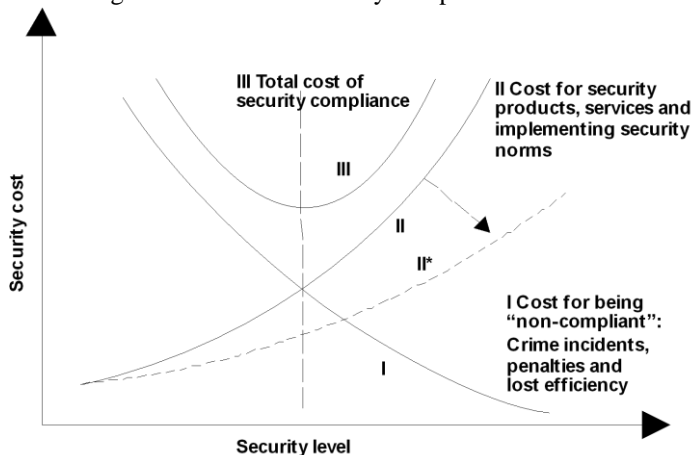
response to them. Complete and structured documentation of assessment is necessary and especially the parts about assessed risks for later risk follow up (positive and negative). In validating risk process it is significantly important that all processes are described in writing and verified. This allows that financial aspects can be covered so they can be check by random sample. Security aspects also have to be check and verified in this process. Next phase is the common risk mapping which starts by presenting outcome of previous phase. Customs has to determine if their assessment corresponds with situation in the company. They have to determine if the company has taken measures to cover risks and how company is making priorities of risks they identified within the company.

Customs has to assess all company's weaknesses and strengths, all their procedures and identified risks. After the assessment is finished, there could be some risks (not significant) that are not covered. These risks are so-called remained risks and they are part of doing business. Customs authorities need to understand the company's significant risks, set the boundaries for taking risks and how the company will respond to identified risks. In case all the risks are covered, Customs administration can grant AEO status. In other case it is necessary to make evaluation if the status should be rejected or processes adjusted and/or improved so company can cover the risks and/or lower them to the level it is acceptable.

## 5. BENEFITS OF AEO CERTIFICATETO SUPPLY CHAIN SECURITY

Companies are investing in supply chain security from several reasons. Ahokas & Hintsa (2010) stated that benefits of supply chain security can be divided in three main groups: direct security benefits; benefits from being the member of supply chain security companies club and collateral benefits. In order to have benefits they noted that companies have to invest in security and that the main task is to balance costs of supply chain security and benefits it can bring. (Figure 3)

Figure 3 Minimizing the total cost of security compliance



Source: adopted from Ahokas, J. & Hintsa J., (2010,p. 12)

Management task in optimization is to lower as much as possible cost for supply chain security compliance which is the lowest point of curve III. Curve II is showing significance of the continuous search for better and more cost effective measures for improving supply chain security and lower cost of security compliance.

Supply chain security investments are important for companies and customs authorities. The AEO certificate is aimed to lower the business costs or even to eliminate them. Butter and van Scheltinga (2008) noted that AEO certificate benefits can be divided in two categories: direct benefits which are resulting from simplification of customs procedure and can bring saving in import and export procedures, and indirect benefits which are resulting from conditions that are in connection with simplified customs procedures and different transactions which certificate can bring. According to the Gutiérrez et al. (2007) benefits of AEO certificate on companies supply chain security is reputation that AEO certificate brings to the company and potential lower insurance premiums due to the lower risks of theft, loss or some other unwanted situations. Other benefits include certainty about physical control, priority control if there is one, fewer physical controls of goods and documents, import and export documents are not re-examined, company knows where the cargo is and, has more precise information about the time the cargo arrives to the destination, etc. Further AEO certificate benefits will depend on increasing the number of companies that have certificate in EU – the more companies have the certificate the higher savings on transactions costs could be and increased supply chain security. Fletcher (2007, p. 64) stated probably the most significant benefit is that *AEO programs established under the SAFE Framework provide mutual recognition – where Customs in one country 'recognizes' and provides benefits based upon a company's AEO status in another country.*

On the other side, increase of supply chain security through AEO certificate benefits also the customs authorities. Direct benefits are seen in simplification of import and export documentation and decrease of number of company controls. This is also increasing efficiency of customs authorities. Indirect benefit is that AEO certificate gives companies additional incentives not to violate the law and that companies have incentives to monitor each other so customs authorities don't have to do that and with that they reinforce effect of certification.

## 6. CONCLUSION

In the recent time on the global market there is increased need to increase supply chain security. Global market is witnessing increased regulation and threats to security with rapid exchange of the information about transport of the goods. Therefore it is important to reinforce and increase existing supply chain security systems or establish new ones with help of effective risk and quality management procedures. Today we can find that different intergovernmental and private organizations are making and issuing these standards for supply chain security

Supply chain security certificates are important for companies because they can benefit from them. Benefits of the AEO certificate for companies include savings in import and export procedures, reputation that AEO certificate brings, potential lower

insurance premiums, and mutual recognition where Customs in one country accepts certificate and provides benefits based upon a company's AEO status in another country. Further AEO certificate benefits will depend on increasing the number of companies that have certificate in EU.

After Croatia entered EU, companies got possibility to apply for AEO certificate. Although AEO certificate is not obligatory it is useful and Croatian companies can have benefits. First applications for AEO have started in autumn of 2013 and until today some 25 companies have applied for AEO certificate. Until now no certificate has been approved since the process of approving is lasting at least 6 months. In order to confirm benefits of AEO certificate for Croatian companies it is necessary to conduct further research in next few years.

## 7. REFERENCES AND SOURCES OF INFORMATION

1. Ahokas, J. & Hintsa, J. (2010). Assuring Supply Chain Continuity in Industrial Supply Chains and Complying with Authorised Economical Operator AEO Europe, BIT Research Center, [available at: [http://legacy-tuta.hut.fi/logistics/publications/Assuring\\_SC\\_Continuity.pdf](http://legacy-tuta.hut.fi/logistics/publications/Assuring_SC_Continuity.pdf), access May 14, 2014]
2. Boske, L. B. (ed.) (2006). Port and Supply-Chain Security Initiatives in the United States and Abroad, Lyndon B. Johnson School of Public Affairs Policy Research Project Report Number 150, University of Texas, Austin, USA
3. Butter, F.A.G. & Scheltinga, W.J. (2008). Kosten en baten van AEO-certificering, Research Institute for Transaction Management, Research prepared for Trade Forum NV, VU University/RITM, Amsterdam [available at: [https://www.feweb.vu.nl/nl/Images/Den%20Butter%20\(2008\)%20-%20Kosten%20en%20baten%20van%20AEO-certificering\\_tcm96-272006.pdf](https://www.feweb.vu.nl/nl/Images/Den%20Butter%20(2008)%20-%20Kosten%20en%20baten%20van%20AEO-certificering_tcm96-272006.pdf), access May 14, 2014]
4. Carinska uprava Republike Hrvatske (2013). Status ovlaštenog gospodarskog subjekta (AEO)[available at:<http://www.carina.hr/Novosti/Novosti.aspx?args=55AhmX%2F8vWNvZibLGsKHtQ%3D%3D>, access April 24, 2014]
5. Closs, D. & McGarrell, E. (2004). Enhancing Security throughout the Supply Chain, IBM Centre for the business of government & Michigan State University, USA
6. European Commission (2006). Commission Regulation (EC) No 1875/2006 of 18 December 2006 amending Regulation (EEC) No 2454/93 laying down provisions for the implementation of Council Regulation (EEC) No 2913/92 establishing the Community Customs Code [available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:360:0064:0125:EN:PDF> access April 14, 2014]
7. European Commission (2006). Authorized Economic Operators - The AEO Compact Model, [available at: [http://ec.europa.eu/taxation\\_customs/resources/documents/customs/policy\\_issues/customs\\_security/aeo\\_compact\\_model\\_en.pdf](http://ec.europa.eu/taxation_customs/resources/documents/customs/policy_issues/customs_security/aeo_compact_model_en.pdf), access May 14, 2014]

8. European Commission (2008). Commission Regulation (EC) No 1192/2008 of 17 November 2008 amending Regulation (EEC) No 2454/93 laying down provisions for the implementation of Council Regulation (EEC) No 2913/92 establishing the Community Customs Code [available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:329:0001:0051:EN:P> DF access May 14, 2014]
9. European Commission (2010). Commission Regulation (EU) No 197/2010 of 9 March 2010 amending Regulation (EEC) No 2454/93 laying down provisions for the implementation of Council Regulation (EEC) No 2913/92 establishing the Community Customs Code [available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:060:0009:0010:EN:P> DF access May 14, 2014]
10. European Commission (2012). Authorized Economic Operators – Guidelines, TAXUD/B2/047/2011 –Rev.3, [available at: [http://ec.europa.eu/taxation\\_customs/resources/documents/customs/policy\\_issues/customs\\_security/aeo\\_guidelines2012\\_en.pdf](http://ec.europa.eu/taxation_customs/resources/documents/customs/policy_issues/customs_security/aeo_guidelines2012_en.pdf) access May2, 2014]
11. European Parliament (2012). Regulation (EU) No 952/2013 of the European parliament and of the Council of 9 October 2013 laying down the Union Customs Code [available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:269:0001:0101:EN:P> DF, access May2, 2014]
12. Fletcher, T. (2007). Authorised economic operator (AEO) programs: IBM's perspective, *World Customs Journal*, Vol. 1 (2), p. 61-66.
13. Gutierrez, X. & Hintsä, J. (2006). Voluntary supply chain security programs: a systematic comparison, paper presented on The International Conference on Information Systems, Logistics and Supply Chain, May 15-17, Lyon, France, p. 1-11.
14. Gutiérrez, X., Hintsä, J., Wieser, P., Hameri, A.P. (2007). Voluntary supply chain security program impacts: an empirical study with BASC member companies, *World Customs Journal*, Vol. 1 (2), p. 31-48.
15. Peterson, J. & Treat, A. (2009). The Post 9/11 Global Framework for Cargo Security, *Journal of International Commerce & Economics*, Vol. 2, September, p. 1 – 30.
16. Szelp, A., (2010). Cargo Security Initiatives in the EU and the USA, their Impact on Business Operations and Mutual Recognition with Focus on AEO and C-TPAT, thesis in International Logistics Management defended on Wirtschaftsuniversität Wien, Austria
17. Tweedle, D. (2008). Logistics, Security and Compliance: The Part to be Played by Authorised Economic Operators (AEOs) and Data Management, *World Customs Journal*, Vol. 2 (1), p. 101-105
18. Urcioli, L. & Ekwall, D. (2009). Supply Chain Security Programs - Comparing business and authority certifications in Hertz, S. (eds.) (2009). *Proceedings of The 21st Annual Nofoma Conference*, 11-12 June 2009 Jönköping Sweden, p. 837-852.
19. Widdowson, D. (2007). The changing role of customs: evolution or revolution?, *World Customs Journal*, Vol. 1 (1) March 2007, pp. 31-37.

## PACKAGING QUALITY ASSURANCE IN SUPPLY CHAIN

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*Scientific paper*

### *Abstract*

Packaging is a very important element in products quality maintenance that is why quality of packaging has great influence and its quality assurance is necessary. Physical flow in supply chain may deteriorate some of packaging features, so their monitoring and proper conditions of storage, transport and suitable protection are important.

The main goal of the paper was to present model of packaging supply chain with elements that are most influencing packaging quality. In the model are considered not only enterprises creating packaging supply chain but also units from its surroundings that have indirect impact. There were analyzed actions that are essential for quality assurance while physical flow of packaging in their supply chains. In the paper are shown the results of the questionnaire research concerning implementation in enterprises of chosen actions, such as: documentation requirement, good hygienic state performance and proper production process conducting. Analyzes were taking under consideration implementation of quality assurance and management systems in units that constitutes packaging supply chain. The research showed that companies are conducting only selected actions, not all required in respect of obligatory and facultative quality management systems, guaranteeing proper packaging quality. Continuous monitoring of quality and safety of product launched on the market is important for consumers protection policy fulfillment.

**Key words:** packaging, packaging supply chain, packaging quality assurance

### **1. INTRODUCTION**

Supply chain is the material and informational interchanges in the logistical process stretching from acquisition of raw materials to delivery of finished products

to the end user. All vendors, service providers and customers are links in the supply chain (Vitasek, 2006).

Therefore supply chain due to European Standard EN 14943 is the sequence of actions, which might concern manufacturing, transport and marketing bringing added value. Whereas as the structure it consist of group of enterprises realizing collective actions necessary to meet the demand on particular products in whole chain of goods flow – from the moment of obtaining raw materials to providing to end-consumer (*Słownikterminologiiilogistycznej*, 2006). In literature there is a lack of publications concerning packaging supply chain. Packaging is very important component of the logistic supply chain of majority of products present on the market. Packaging has a lot functions in the supply chain: protection of packed product, informative, logistical, economic and ecological.

Protection the objects enclosed in the package from quantitative and/or qualitative losses may require protection from physical factors such as: mechanical shock, vibration, electrostatic discharge, compression, temperature and biological, chemical and other factors. Packaging that creates a barrier from e.g. oxygen, water vapor, dust, etc. is often required. Keeping the contents clean, fresh, sterile and safe for the intended shelf life is a primary function. The protective function of packaging relies on protection the environment and user against products (dangerous materials and dangerous chemical substances) (Regattieri&Santarelli, 2013).

Packaging is a media of information transmission; in supply chain it is essential to provide proper information for products distributors, retailers and consumers. Handling marking helps to proper handling during storage and transportation of goods. Packaging might also be a carrier of electronic devices like RFID (Radio-frequency identification) tags which helps to identify the products in real time, reducing the risk of thefts and increasing security. Packages can be used by marketers to encourage potential buyers to purchase the product.

Logistic function of packaging strictly impacts the effectiveness of informative-control, transport, handling or storage activities leading to proper functioning of the supply chain (Zemka-Podlaszewska&Tichoniuk, 2012).

The cost of packaging in the supply chain should be lower than the economic benefits of its application. The economic calculation should contain costs packaging with respect to whole packaging life cycle from raw materials obtain to waste management.

The ecological function should lead to meet all packaging supply chains stakeholders requirements.

The structure of packaging supply chain is formed by enterprises related to whole packaging life cycle is presented on fig. 1 (Bix, 2009).

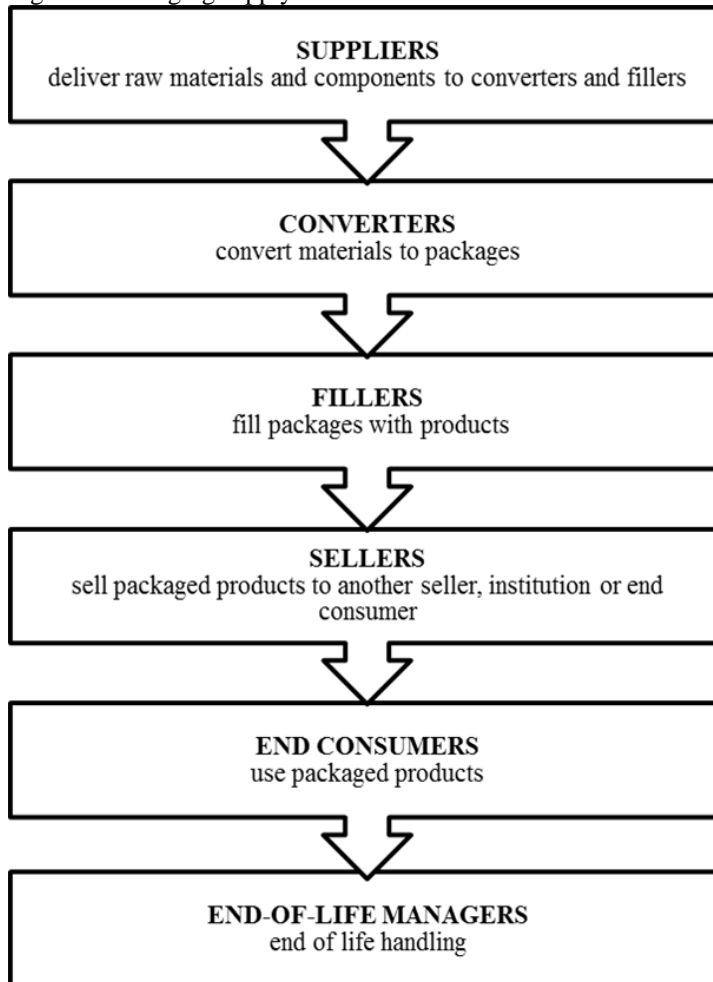
Packaging supply chain might be considered in relationship with logistics. In this chain are present physical flows, information flows, sequences of processes, relations between subjects, inputs and outputs of systems or structures. Important is also surroundings influencing on chain performance (Cholewa, 2006).

Raw materials and packaging elements suppliers are first step of physical flows in supply chain. Then materials are forwarded to packaging materials and packaging producers. The next step is packaging distributors or packaging users, which in packing process are shaping packaging or filling in ready packaging. Packaged

products are forwarded to end-consumers. Consumers are transferring packaging waste to enterprises from the sector of waste management.

On packaging supply chain is influencing surroundings like government agencies, legislative bodies, national and international organizations, associations of producers, distributors and consumers.

Figure 1 Packaging supply chain



Source: own work on the basis of (Bix, 2009)

## **2. INFLUENCE OF PACKAGING APPLICATION ON CATEGORY OF RISK**

Packaging sector is very diverse, raw materials, technologies, forms, shapes and applications are very different. Dynamic development of this sector and changing legislative and consumers requirements forces to classify group of packaging due to risk they might cause to packaged goods.

The requirements depend on the type of packaging produced. Due to BRC/IoP standard (Global Standard for Packaging and Packaging Materials) it might be possible to group packaging on two categories:

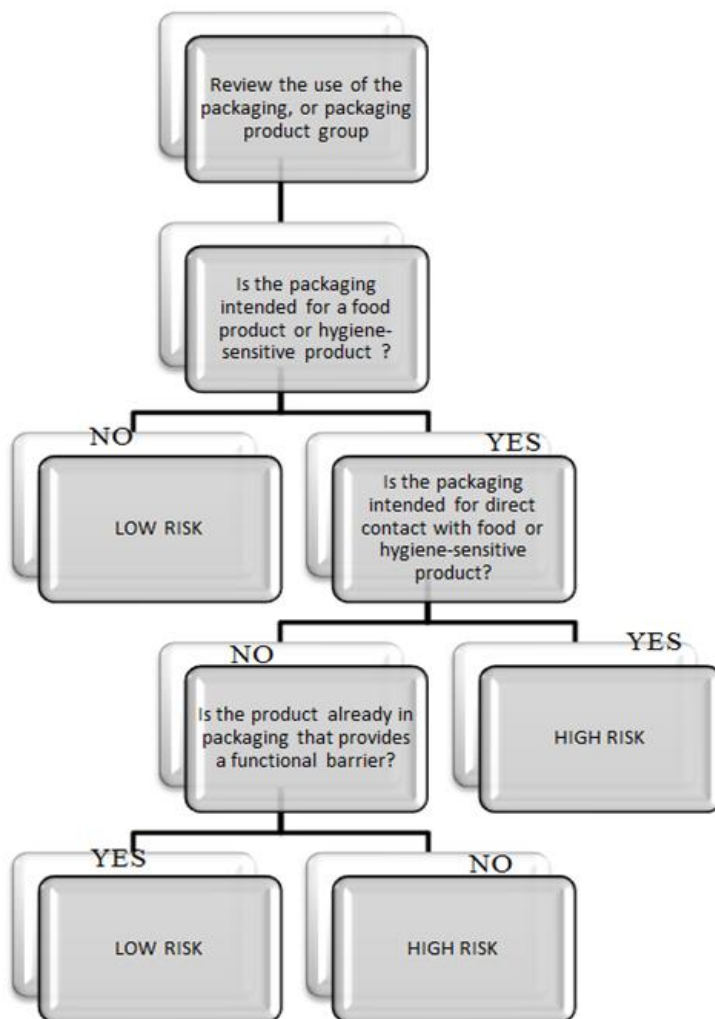
- Packaging directly contacting with products of increased requirements (such as food, pharmaceuticals, cosmetics).
- Packaging for non-direct contact with products of increased requirements or for product of regular requirements.

The decision tree in figure 2 determines the appropriate packaging risk category and should be used to decide which risk category is relevant.

Proper category of risk selection determines range of requirements which must be met to ensure effective activities in whole processes in supply chain. Moreover it is important that all activities are lead in order to requirements of quality assurance systems operating in supply chain companies.



Figure 2 Decision tree for packaging category determination



Source: Guide to Enrolment Program for BRC Global Standard for Packaging and Packaging Material issue 4, London 2014.

### 3. PACKAGING QUALITY ASSURANCE

The quality of packaging is essential; it is important element of products quality and supply chain effectiveness. On the quality of packaging influencing: quality of raw materials, proper conduct of the production, storage, transport and distribution processes in company. That is why a lot of companies implement quality assurance or management systems (Lisińska-Kuśnierz&Kawecka, 2013).

In respect to packaging risk category there are different requirements. The most restrictive requirements concerning food packaging, they are stated in legal acts like:

- Regulation (EC) No 1935/2004 of the European Parliament and of the Council of 27 October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC
- Commission Regulation (EC) No 2023/2006 of 22 December 2006 on good manufacturing practice for materials and articles intended to come into contact with food.

The most important requirements in respect to food packaging is that materials shall be manufactured in compliance with good manufacturing practice so that, under normal or foreseeable conditions of use, they do not transfer their constituents to food in quantities which could: endanger human health, bring about an unacceptable change in the composition of the food and bring about a deterioration in the organoleptic characteristics thereof (Regulation (EC) No 1935/2004). Moreover the packaging labelling, advertising and presentation shall not mislead the consumers. Regulation also states that (Regulation (EC) No 1935/2004):

- the traceability of packaging materials shall be ensured at all stages in order to facilitate control, the recall of defective products, consumer information and the attribution of responsibility.
- business operators shall have in place systems and procedures to allow identification of the businesses from which and to which materials are supplied.
- the materials which are placed on the market shall be identifiable by an appropriate system which allows their traceability by means of labelling or relevant documentation or information.

Commission Regulation (EC) No 2023/2006 of 22 December 2006 on good manufacturing practice for materials and articles intended to come into contact with food requires the business operator shall establish, implement and ensure adherence to an effective and documented quality assurance system. Quality assurance system is understood as: “the total sum of the organized and documented arrangements made with the purpose of ensuring that materials and articles are of the quality required to ensure conformity with the rules applicable to them and the quality standards necessary for their intended use” (Commission Regulation (EC) No 2023/2006).

The quality assurance system must be characterized adequacy of personnel, their knowledge and skills, and the organization of the premises and equipment such as is necessary to ensure that finished materials and articles comply with the rules applicable to them and is taking into account the size of the business run by the operator, so as not to be an excessive burden on the business.

Moreover the packaging sector operators should implement proper quality control systems, which ensure effective quality control and ensure monitoring of the implementation and achievement of Good Manufacturing Practice (GMP) and identify measures to correct any failure to achieve GMP. Such corrective measures

shall be implemented without delay and made available to the competent authorities for inspections.

Beside the obligatory systems, there are facultative quality management systems. In respective to food packaging operators there are functioning:

- ISO 9001:2008 Quality management systems – Requirements.
- ISO 22000:2005 Food safety management systems – Requirements for organizations throughout the food chain.
- EN 15593:2008 Packaging – Management of hygiene in the manufacture of packaging for food – requirements.
- The BRC/IOP Global Standard for Packaging & Packaging Materials.

ISO 9001:2008 specifies requirements for a quality management system where an organization needs to demonstrate its ability to consistently provide product that meets customer and applicable statutory and regulatory requirements, and aims to enhance customer satisfaction through the effective application of the system. Moreover including processes for continual improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements (ISO 9001:2008).

ISO 22000:2005 specifies requirements for a food safety management system where an organization in the food chain needs to demonstrate its ability to control food safety hazards including food packaging hazards in order to ensure that food is safe at the time of human consumption. It is applicable to all companies, irrespective of size. The system is dedicated to operators which are involved in any aspect of the food chain including production, distribution of packaging and packing process, and want to implement systems that consistently provide safe products (ISO 22000:2005).

The EN 15593 Standard is devoted to all organizations that want to effectively manage the hygiene in the production of packaging for food. The requirements of the standard include health management system, hazard analysis and risk assessment, pollution sources and requirements for plants and personnel. EN 15593 can be a tool to improve the quality management system for packaging of food (EN 15593:2009).

The BRC/IOP Global Standard for Packaging & Packaging Materials is dedicated for packaging sector companies which produce packaging and packaging materials used in food and non-food industry. The main idea in creating the standard was to provide an efficient tool for packaging industry to ensure consumers safety and fulfilment of legal requirements (BRC/IOP Global Standard for Packaging & Packaging Materials).

A large number of management systems to compliance forces at least minimum level of integration of management systems in order to ensure the effective functioning of the supply chain stakeholder. Currently there are standard guidelines for the integration of the management systems (Nowicki et al., 2013). Integration might be lead based on models like (Kafel&Sikora, 2010):

- Global SAI. AS/NZS 4581:1999 Management system integration – guidance to business, government and community organizations,
- HB 10190:2001 IMS: The framework (Integrated Management Systems Series),

- PAS 99 Specification of common management systems requirements as a Framework for integration,
- NTS (1996) Management Principles for Enhancing Quality of Products and Services, Occupation Health and Safety and the Environment,
- DS 8001:2005 Management System – Directive on developing and Integrated Management System,
- UNE 66177:2005 Integración Sistemas de Gestión.

The integration of management systems bring many benefits for organization such as: improvement of effectiveness and efficiency, reduce costs in whole activities areas, especially the number of internal and external audits and increase competitiveness of companies from supply chain.

#### 4. CONCLUSIONS

Packaging is a very important element in products quality maintenance that is why quality of packaging has great influence and its quality assurance is necessary. Physical flow in supply chain may deteriorate some of packaging features, so their monitoring and proper conditions of storage, transport and suitable protection are important. Following the procedure of quality management systems is the guarantee of packaging quality assurance. The requirements of implemented systems are different in respective to different packaging risk category. Although functioning obligatory and facultative quality management systems it is essential their conscious implementation and monitoring of their activity for proper adjustment to packaging risk category. Only those activities might bring expected and effective results.

It is necessary to conduct continuous monitoring of obligatory quality assurance systems implementation in enterprises constituting packaging supply chain. It is important for consumer's protection policy fulfillment, which is one of the basis of common market rule in European Union.

#### 5. REFERENCES

1. Bix, L., de la Fuente, J., Sundar, R. P., Lockhart, H. (2009). Packaging Design and Development, *The Wiley Encyclopedia of Packaging Technology*, K. Yam (ed.), J. Wiley and Sons. Danvers.
2. Cholewa, A. (2006). Research and estimation of transport packaging as element of distribution system, *Proceedings of the 15th IGWT Symposium: Global Safety of Commodity and Environment Quality of Life*, Kiev, Ukraine, 12-17 September 2006, s. 1077-1080.
3. Commission Regulation (EC) No 2023/2006 of 22 December 2006 on good manufacturing practice for materials and articles intended to come into contact with food
4. *Guide to Enrolment Program for BRC Global Standard for Packaging and Packaging Material issue 4* (2014), London.

5. Kafel, P. & Sikora, T. (2010). Integrated Management Systems Certification – Survey Results, *Journal of Economics and Organization of Future Enterprise*, 1.
6. Lisińska-Kuśnierz, M. & Kawecka, A. (2013). The role of packaging supply chain in food packaging safety assurance, *Logistics and Transport*, Vol. 19, No 3, p. 37-44.
7. Nowicki, P., Kafel, P., Sikora, T. (2013). Selected requirements of Integrated Management Systems Based on PAS 99 Specification, *International Journal for Quality Research* 7(1), p. 97-106.
8. Regattieri, A. & Santarelli, G. (2013). The Important Role of Packaging in Operations Management, *Operations Management*, Massimiliano M. Schiraldi (ed.), InTech.
9. Regulation (EC) No 1935/2004 of the European Parliament and of the Council of 27 October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC
10. *Słownik terminologii logistycznej* (2006), ILiM, Poznań.
11. Vitasek, K. (2006). *Supply Chain and Logistics Terms and Glossary*, Bellevue, Washington.
12. Walters, D. (2011). *Supply Chain Risk Management. Vulnerability and Resilience in logistics*, KoganPage, London, Philadelphia, New Delhi.
13. Zemka-Podlaszewska, D. & Tichoniuk, M. (2012). The role of packaging in supply chain risk management, *Product and Packaging. Tendencies for development in logistics*, J. Lewandowski, A. Walaszczyk, M. Sekieta, (ed.), Łódź.



### **III. LOGISTICS IN THEORY AND PRACTICE**





## **A COMPARATIVE LITERATURE ANALYSIS OF DEFINITIONS FOR LOGISTICS: BETWEEN GENERAL DEFINITION AND DEFINITIONS OF SUBCATEGORIES**

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*Scientific paper*

### ***Abstract***

Today we still have some doubts about definition of logistics, thus we strive to find a uniform one. As very professionals CSCMP gave definition of logistics which we found not suitable for definition of logistics in general, since it covers only business and industrial area. Our general objective was to find common understanding of the context of logistics as a discipline which will enable better collaboration between multiple entities in different environments, as they can

understand and interoperate with each other correctly. With analysis of some logistics subcategories we first created definitions for them and then compared with each other and also with the one from CSCMP. As a result we create new upgradable definition of logistics in general and also found out some common elements of definitions of military and sports logistics, of definitions of business / industrial and agricultural logistics, as well as of definitions of humanitarian logistics and logistics in health care.

**Key words:** definition, logistics in general, logistics subcategories

## 1. INTRODUCTION

About the meaning, significance and content of logistics and even on what should constitute it, much has already been written, but discussions on this topic have not yet completed. As a discipline worth of studying, logistics has developed relatively late and therefore it is also relatively young scientific discipline. That is why today we still have some doubts about the definition of logistics. Of course we do not expect a single definition in the sense that we should always have to use the same words in the same sequence. Uniform definition should rather primarily clarify the relationship between the elements of logistics and its subsections, which for sure will give us the framework of logistics as a discipline.

At present time, the importance of logistics is increased in many economic branches, especially in industry and business. Logistics is considered to be a science, dealing with the integrated management of all the material and the corresponding information flow from suppliers through transformation of input materials up to the end consumer. Though there is no unified definition of logistics, most of the authors agree with this explanation. The importance and the volume of material and information flow increases especially in the contemporary global environment, when subjects from different countries and continents integrate into production and business. To manage the material and information flow successfully, it is necessary to have a good overview concerning its volume and structure.

Early references to logistics refer primarily to military logistics, which has reached its expansion during both World Wars, when the amount of troops and equipment (and its diversity) increased (Luttwak, 1971; Lummus et al, 2001, p. 426; Tseng et al, 2005, pp. 1659-1660). In the era of relative peace logistics was given the opportunity to penetrate to the business arena, and by the rapid development it has overtaken military logistics (Rodrigue & Slack, 2002, p. 214). We assume, this is the breakpoint of division of its definition and the perception of what elements or activities should logistics include. We can illustrate this very moment with American Production and Inventory Control Society's (Blackstone, 2013, p. 94) definition of logistics, where it is first described civil logistics and then military:

*... In an industrial context, the art and science of obtaining, producing, and distributing material and product in the proper place and proper quantities.*

*In a military sense (where it has greater usage), its meaning can also include the movement of personnel.*

Council of Supply Chain Management Professionals (CSCMP) (CSCMP Supply Chain Management, 2014) most closely associated with the logistics profession today defines logistics (management) as:

*... that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements.*

It seems that definition of business logistics today does not include the movement of people anymore. It also seems that definition of logistics in general today is identified primarily by business / industrial logistics. Probably because its development in recent times was the most advanced and thus dictated the pace of development of logistics as a scientific discipline.

The question is: Does the definition of logistics in general include all the elements of today's context of logistics as discipline? We will try to answer to this question with the help of relationship between definitions of logistics in general and with definitions of some of logistics subcategories.

Our general objective of the paper is, however, to find common understanding of the context of logistics as a discipline which will enable better collaboration between multiple entities in different environments, as they can understand and interoperate with each other correctly. In addition to our general objective we will also form overall definitions for some subcategories of logistics: agricultural logistics, tourism logistics, logistics in health care, sports logistics, military logistics, and humanitarian logistics.

## 2. PROCEEDINGS OF RESEARCH

First, we chose the most modern definition of logistics (already represented in the Introduction), which was formed by CSCMP, the professional organization most closely associated with the logistics profession. We call this definition as a "starting point definition of logistics in general".

In the second phase we have selected some of the areas of logistics, which have recently been very topical: humanitarian logistics, sports logistics, tourism logistics, logistics in health care, and agricultural logistics. We reviewed some of their definitions and contexts in the literature, as well as looking for common features for each area to create common definition for single area, which we call "definition of logistics subcategory".

We have been searching for usable scientific papers on internet over different science databases. Mainly we were focusing on ScienceDirect, Springer, Scopus, Jstor, Sabinet, Emerald and Wiley, where we found over 300 different articles, from which we chose 176 articles suitable for our research. The problem was that they did not always include exact definition about individual logistics subcategory – in many cases they were just refereeing to it, or just mentioning it. Nevertheless we were analysing selected papers to find all definitions and the contexts which then we

posted them one after other. We used 26 definitions for agricultural logistics, 35 definitions for tourism logistics, 37 definitions for logistics in health care, 16 definitions for sports logistics, 37 definitions for military definitions, and 18 definitions for humanitarian logistics. We also used some descriptions of concrete actions of each subcategory with the help of other web sources. After that we were searching for common features and differences to create definitions for each individual logistics subcategory.

At the end we posted all definitions of logistics subcategories one after other to search for common features and difference between them and also between starting point definition of logistics in general. The last action was the creation of common definition of logistics in general, which we call the "final definition of logistics in general".

## 2.1. Results

We chose our starting point definition of logistics in general from CSCMP, which defines logistics management as follows in Table 1.

Table 1 Starting point definition of logistics in general

Reference	Definition	Category
[6]	Logistics (management) is that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements.	Business / industrial logistics

Source: Council of Supply Chain Management Professionals

After we analysed all the selected papers to find all definitions of selected subcategories we create definitions for individual logistics subcategory as follows in Table 2.

Table 2 Definitions of logistics subcategories

References	Definition	Subcategory
26 definitions [7 – 32]	Logistics in agriculture is an activity that spreads from agricultural product producer to the final consumers in order to satisfy customers' different demands, including the links such as agricultural product production, purchasing, transportation, warehousing, loading and unloading, handling, packaging, processing, distribution and information processing. Agricultural logistics is important part of economy which controls, coordinates and organizes different flows of logistics (information, goods and financial flow). Its important part is physical transportation which has some restrictions due to of its vulnerable of goods (weather conditions have to be met: temperature, moister), transport distances have to be minimized if possible (cause of food hazarding or animal welfare) and traceability (from farm to fork) plays an important role in food safety and consumer confidence.	Agricultural logistics
35 definitions [33 – 67]	Tourism logistics is transportation of people from a place of origin to wanted destination at the exact time, on the same note logistics is responsible for transportation of goods within the whole tourism industry. Logistics in tourism is composed of the carriers, accommodation places, restaurants, sightseeing, man-made attraction ventures, car rental firms and whole setting, décor, appearance of staff, and timeliness of the service received for which it is essential co-operation and co-ordination of different activities and co-ordination of the area.	Tourism logistics
37 definitions [68–104]	Logistics is part of the health care supply chain, consisting of purchasing activities, warehousing, planning, transport, distribution and control. The importance of logistics is reflected in the effective implementation of patient care services by providing real flow of goods / drugs / food / patients / spare human organs, the right information, at the right time with the right equipment / devices / experts and other personel, in the right place, all in adequate quality and the right quantity. In this way, provides logistics support to the health workers and at the same time reducing costs.	Logistics in health care

16 definitions [105–120]	Sports logistics supports the execution of sporting events with a cost-effective organization of environmentally friendly services necessary for the timely execution of the event itself and relate to athletes, spectators and organizational staff, which adapt logistics. Thus, among other things, logistics provides transportation, storage and tracking of necessary equipment, and other sports, during sporting events. It also participates in the creation of a sports event location and accessibility of spectators to the venue. Organizing staff provides the conditions for the execution of the event. It allows the transfer of information through information systems, and implementation of security requirements to ensure the safety of the participants of the event.	Sports logistics
37 definitions [121–158]	Military logistics is one of the most important disciplines in the field of implementation and support of military expeditions and the development of military strategies. The basic activity of the deals is the safest and quickest possible transport units, storage and transport of equipment and supplies necessary for the maintenance of military operations on the battlefield and back after the completion of surgery. This ensures through a comprehensive capability to fulfill the functions of industrial mobilization, development, finance, administration, procurement, distribution, recruiting, training, testing and removal of unnecessary, making it the assurance of operational capacity. Military logistics is accompanied by a wide range of activities, linking these activities and provides resources that enable activities. Military logistics also include the creation and management of institutions that provide management of combat support forces and related services - the most prominent example of such institutions is military hospitals. Military logistics mainly aim to supply a mobile demand (military units) from relatively static supply sources.	Military logistics
18 definitions [159–176]	Humanitarian logistics is the process of planning, implementing, monitoring, transport and storage of goods. The flow of information is crucial for control of the whole situation. It can also be defined as emergency assistance to the affected areas and people, who have a number of competent personnel who have the necessary knowledge and at key moments find practical solutions at cost-effective processes. It consists of preparation, response and reconstruction phases. The most important is phase response, because at the time of the rapid reaction it can reduces the potential number of victims. But crucial phase is also prepartaion, which helps to avoid the gravest possible consequence.	Humanitarian logistics

Source: Ours

At the end we posted all definitions of logistics subcategories one after other (like in Table 2) to search for common features and difference between them and also between starting point definition of logistics in general.

We found out, that starting point definition of logistics in general does not include movements / flows of people / personel, while some subcategories do: military logistics, tourism logistics, logistics in health care, and sometimes sports logistics and humanitarian logistics. Agricultural logistics does not include movements of people according to the created definition.

The last action was the creation of common definition of logistics in general, which we call the "final definition of logistics in general". What is common throughout all definitions of logistics (in general and its subcategories) is that ...

*... it entails different activities such as planning, production, purchasing, transportation, warehousing, loading and unloading, handling, packaging, processing, distribution, control, information processing and traceability. These activities in the right proportion are necessary to achieve the basic goal of logistics which is reflected in the effective flow of goods / services / people / information, at the right time with the right equipment / devices / competent personel, in the right place, all in adequate quality and the right quantity in order to satisfy customers. Logistics should also strive to be cost-effective and environmentally friendly.*

## 2.2. Discussion

Since our research consisted of three phases, first we chose the starting point definition. Despite the fact that there are many definitions of logistics in general we decided to choose the one, that was made by the very professionals i.e. CSCMP. We found out that this definition actually covers the subcategory business / industry, thus we can denoted it as too narrow (or too professional) to cover logistics discipline in general.

The second phase thus entails the analysis of definitions of selected logistics subcategories that are very topical in recent time i.e. agricultural logistics, tourism logistics, logistics in health care, sports logistics, military logistics and humanitarian logistics. These analysis allowed us to create common definitions of logistics subcategories, represented in Table 2 of this paper.

The third phase was made to compare definitions of logistics subcategories with each other and also with starting point definition of logistics in general.

What is common throughout all definitions is that they entail the elements represented in final definition of logistics in general, which include all the elements of subcategories (for example flow of people / personnel / equipment etc.).

While comparing definitions of logistics subcategories we also found out some similarities or common points between definition of military and sports logistics. Sports logistics and military logistics in addition to other entail elements such as storage and transport of equipment during events (games or war) and also during trainings. Personnel participate in the creation of an event location as well as it provides the conditions for the execution of the event. Both allow the transfer of information through information systems, and implementation of security

requirements to ensure the safety of the participants of the event. Both mainly aim to supply a mobile demand from relatively static supply sources, since we have to have in mind that sport is still a national category. This means they can both learn from each other and also contribute to development of each subcategory.

We also found out that definition of agricultural logistics is very similar to definition of business / industry logistics, since they both include activities that spread from product producer to the final consumers in order to satisfy customers' different demands, including the activities such as production, purchasing, transportation, warehousing, loading and unloading, handling, packaging, processing, distribution and information processing. Agricultural logistics as business / industrial logistics are important part of economy which controls, coordinates and organizes different flows of logistics (information, goods and financial flow). The important part of both is physical transportation which has some restrictions due to of its vulnerable of goods, transport distances have to be minimized if possible and traceability plays an important role to satisfy customers.

Many common elements have also definitions of humanitarian logistics and logistics in health care, since they both include elements such as planning, transport and warehousing / storage of goods, monitoring / control. The flow of information and competent personnel is exposed in both subcategories. Although definition of logistics in health care does not consists of preparation, response and reconstruction phase we recommend it should.

### **3. CONCLUSION**

Today definition of logistics in general can be recognized in definition of business / industrial logistics, since it prevails in the market and its development was the most advanced. Thus it dictates the pace of development of logistics as a scientific discipline as well as its subcategories, and it behaves as a discipline itself. But as we represented in this paper, definition of logistics by the CSCMP does not include all of the elements, which can be identified in its subcategories, thus can not be definition of logistics in general. Definition in general should include at least these components: planning, production, purchasing, transportation, warehousing, loading and unloading, handling, packaging, processing, distribution, control, information processing and traceability. The basic goal of logistics is reflected in the effective flow of goods / services / people / information, at the right time with the right equipment / devices / competent personnel, in the right place, all in adequate quality and the right quantity in order to satisfy customers. Logistics should also strive to be cost-effective and environmentally friendly. Military logistics and sports logistics have some common elements that indicate they should learn from each other and also contribute to both subcategories. The same is with the relation between business / industrial logistics and agricultural logistics, and with humanitarian logistics and logistics in health care.



#### 4. REFERENCES AND SOURCES OF INFORMATION

1. Blackstone, J. H. (ed.). (2013). APICS Dictionary. 14th Edition. Chicago: APICS, [available at: <http://www.feg.unesp.br/dpd/scm/claudemir/part3/Apics%20Dictionary.pdf>, access September 23, 2014]
2. CSCMP Supply Chain Management, Council of Supply Chain Management Professionals, [available at: <http://cscmp.org/about-us/supply-chain-management-definitions>, access September 19, 2014]
3. Lummus, R. R., Krumwiede, D. W., Vokurka, R. J. (2001). The relationship of logistics to supply chain management: developing a common industry definition. *Industrial management & Data Systems*, 101 (8), pp. 426–431.
4. Luttwak, E. (1971). *A Dictionary of Modern War*. Harper & Row: New York.
5. Rodrigue, J. P. & Slack, B. (2002). Logistics and National Security. In Majumdar, S.K. et al. (ed.). *Science, Technology, and National Security*. Easton, PA: Pennsylvania Academy of Science, pp. 214–225.
6. Tseng, Y., Yue, W. L., Taylor, M. A. P. (2005). The Role of Transportation in Logistic Chain. *Proceedings of the Eastern Asia Society for Transportation Studies*, 5, pp. 1657–1672.
7. Bosona, T. & Gebresenbet, G. (2012). Logistics and Supply Chains in Agriculture and Food. In Groznik, A. (ed.). *Pathways to Supply Chain Excellence*. Sweden: InTech, pp. 125–146.
8. Chen, Y., Li, D., Li, L., Zheng, Y. (2012). A Bayesian Based Search and Classification System for Product Information of Agricultural Logistics Information Technology. *Computer and Computing Technologies in Agriculture V*. IFIP Advances in Information and Communication Technology. Daoliang, L & Yingyi, C (ed.). China Agricultural University, Beijing, 29 -30 October, 2011, pp. 437–444.
9. Junhua, L. & Zhong, Q. Better Atmosphere for Booming Agro Logistics in China, [available at: <http://www.seiofbluemountain.com/upload/product/200911/2006zxqyhy15a2.pdf>, access September 19, 2014]
10. Kaláb, D. & Vaněček D. (2003). Logistics in agricultural production. *Agricultural Economics*. – Czech, 49 (2003), pp. 439–443.
11. Liping, W. (2012). Study on Agricultural Products Logistics Mode in Henan Province of China. In Wu, Y. (ed.), *Software Engineering and Knowledge Engineering: Theory and Practice*. China: Central China Normal University, pp. 635–640.
12. Meyer, F., Sundmaeker, H., Verdouw, C. N., Verhoosel, J. & Wolfert, J. Smart Agri-Logistics: Requirements for the Future Internet, [available at: [http://www.smartagrifood.eu/sites/default/files/content-files/downloads/Smart%20Agri-Logistics%20conference%20paper%202012-02-29\\_0.pdf](http://www.smartagrifood.eu/sites/default/files/content-files/downloads/Smart%20Agri-Logistics%20conference%20paper%202012-02-29_0.pdf), access September 19, 2014]
13. Paulina, P. & Timpanaro, G. (2012). Ethics, sustainability and logistics in agricultural and agri-food economics research. *Italian Journal of Agronomy*, 7 (e33), pp. 237–246.

14. Van Kasteren, J. Platform Agrologistics: Improving logistics for the agricultural industry. [available at: [http://www.agrologistiek.nl/download/s/Agro\\_folder\\_UK\\_06\\_web.pdf](http://www.agrologistiek.nl/download/s/Agro_folder_UK_06_web.pdf), access September 19, 2014]
15. Zhang, X. & Wang, C. Application of Analytic Network Process in Agricultural Products Logistics Performance Evaluation, [available at: [http://download.springer.com/static/pdf/275/chp%253A10.1007%252F978-3-642-23993-9\\_72.pdf?auth66=1411559395\\_fe0347cabdadd2cd5f7c4b98979b841&ext=.pdf](http://download.springer.com/static/pdf/275/chp%253A10.1007%252F978-3-642-23993-9_72.pdf?auth66=1411559395_fe0347cabdadd2cd5f7c4b98979b841&ext=.pdf), access September 19, 2014]
16. Yingxia, Z. & Xiangyu, G. The Research on Chinese Agricultural Product Logistics Based on the Supply Chain, [available at: <http://www.agriskmanagementforum.org/sites/agriskmanagementforum.org/files/Documents/12651774740z0nfa8s.pdf>, access September 19, 2014]
17. Collins, A., Henchion, M., O'Reilly, P. (2001). Logistics customer service: performance of Irish food exporters. *International Journal of Retail & Distribution Management*, 29 (1), pp. 6–15.
18. Manos, B. & Manikas, I. (2010). Traceability in the Greek fresh produce sector: drivers and constraints. *British Food Journal*, 112 (6), pp. 640–652.
19. Folinas, D, Manikas, I., Manos, B. (2006). Traceability data management for food chains. *British Food Journal*, 108 (8), pp. 622–633.
20. Jasaitis, J. Economic benefits of logistics application in the agriculture sector, [available at: [http://vddb.library.lt/fedora/get/LT-eLABa-0001:J.04-2011-ISSN\\_2029-8846.N\\_2.PG\\_353-354/DS.002.1.01.ARTIC](http://vddb.library.lt/fedora/get/LT-eLABa-0001:J.04-2011-ISSN_2029-8846.N_2.PG_353-354/DS.002.1.01.ARTIC), access September 19, 2014]
21. Paché, G. (1998). Logistics outsourcing in grocery distribution: a European perspective. *Logistics Information Management*, 11 (5), pp. 301–308.
22. Gebresenbet, G. & Bosona (2012). T. Logistics and Supply Chains in Agriculture and Food, [available at: <http://cdn.intechopen.com/pdfs-wm/32382.pdf>, access September 19, 2014]
23. Hsiao, H.I., van der Vorst, J.G.A.J., Kemp, R.G.M., (Onno) Omta, S.W.F. (2010). Developing a decision-making framework for levels of logistics outsourcing in food supply chain networks. *International Journal of Physical Distribution & Logistics Management*, 40 (5), pp. 395–414.
24. Angeles Sanfiel-Fumero, M., Ramos-Dominguez, Á. M., Oreja-Rodríguez, J. R. (2012). The configuration of power in vertical relationships in the food supply chain in the Canary Islands: An approach to the implementation of food traceability. *British Food Journal*, 114 (8), pp. 1128–1156.
25. Caputo, M. & Mininno, V. (1998). Configurations for logistics co-ordination: A survey of Italian grocery firms. *International Journal of Physical Distribution & Logistics Management*, 28 (5), pp. 349–376.
26. Niederhauser, N. & Oberthur, T. (2008). Information and its management for differentiation of agricultural products: The example of specialty coffee. *Computers and Electronics in Agriculture*, 61 (2), pp. 241–253.
27. Ahumada, O. & Villalobos, J. R. (2011). Operational model for planning the harvest and distribution of perishable agricultural products. *International Journal of Production Economics*, 133 (2), pp. 677–687.

28. Charlebois, S. (2008). The gateway to a Canadian market-driven agricultural economy: A framework for demand chain management in the food industry. *British Food Journal*, 110 (9), pp. 882–897.
29. Daoping, W., Feng, L., Lei, C. (2012). Causality and Reasons of Agricultural Production and Agricultural Logistics Practitioners in China. *Affective Computing and Intelligent Interaction, Advances in Intelligent and Soft Computing*, 137, pp. 29–34.
30. Liping, W. (2009). Study on Agricultural Products Logistics Mode in Henan Province of China. *Software Engineering and Knowledge Engineering, Advances in Intelligent and Soft Computing*, 115, pp. 635–640.
31. Gan, W., Zhu, Y., Zhang, T. (2011). On RFID Application in the Tracking and Tracing System of Agricultural Product Logistics. *Computer and Computing Technologies in Agriculture IV, IFIP Advances in Information and Communication Technologies*, 345, pp. 400–407.
32. Yao, X, Cui, Y., Ying, J., Wei, J. (2009). Dynamic Alliance of Agriculture Products Logistics Based on Swarm Intelligence. *Computer and Computing Technologies in Agriculture II*, 1 (293), pp. 761–769.
33. Amoah, V. & Baum, T. (1997). Tourism education: policy versus practice. *International Journal of Contemporary Hospitality Management*, 9 (1), pp. 5–12.
34. Annibal, J., Junqueira, L., Felipe, L. (2001). The Tourism Industry Chain: Hospitality and Tourism, [available at: <http://www.pomsmeetings.org/Meeting2001/2001/cd/papers/pdf/Annibal%20-%20Hospitality%20&%20Tourism%20%28The%20Tourism%20Industry%20Chain%29.pdf>, access September 19, 2014]
35. Augustyn, M. (1998). The road to quality enhancement in tourism. *International Journal of Contemporary Hospitality Management*, 10 (4), pp. 145–158.
36. Baer, S. (2006). Ganzheitliches Tourismus-Marketing: Die Gestaltung regionaler Kooperationsbedingungen, [available at: <http://www.amazon.de/Ganzheitliches-Tourismus-Marketing-Gestaltung-regionaler-Kooperationsbeziehungen/dp/3835002759>, access September 19, 2014]
37. Budeanu, A. (2009). Environmental supply chain management in tourism: The case of large tour operators. *Journal of Cleaner Production*, 17 (16), pp. 1385–1392.
38. Đorđević, M. (2010). Supply Chain Management in Tourism, [available at: <http://www.cqm.rs/2010/4iqc/pdf/012.pdf>, access September 19, 2014]
39. Eccles, G. (1995). Marketing, sustainable development and international tourism. *International Journal of Contemporary Hospitality Management*, 7 (7), pp. 20–26.
40. Eraqi, M. (2006). Tourism services quality (TourServQual) in Egypt: The viewpoints of external and internal customers. *Benchmarking in Total Quality Management*, pp. 469–492.
41. Eastham, J., Sharples, L., Ball, S. Supply Chain Management. Issues for the Hospitality and Retail Sectors. *Tourism recreation research*, 36 (3), pp. x–x.

42. Tourismus Supply Chain Information Sharing Analysis, Gernay Papers, 23th of November 2012.
43. GfK SirValUse, Tourismus & Transport, [available at <http://www.sirvaluse.com/de/branchen/tourismus-transport/einfuehrung.html>, access May 2, 2013]
44. Ivanović, Z. & Baldigara, T. Logistics Processes in a Tourism Destination, [available at: <http://web.ebscohost.com.ezproxy.lib.ukm.si/ehost/detail?vid=9&sid=e3d1f347-e726-4c6b-9b5e8e008a65d40e%40sessionmgr113&hid=124&bdata=Jmxhbm9c2wmc2l0ZT1laG9zdC1saXZl#db=ecn&AN=0965071>, access May 8, 2013]
45. Josep M., (2012). Selling Tourism Services at a Distance: An Analysis of the EU Law Consumer Acquis. Toursim School, University of Girona. Girona: Spain.
46. Kordel, Z. (2008). Logistics in Tourism and Recreation. *GeoJournal of Tourism and Geosites*, 2(2), pp. 137–139.
47. Kovačić, N. (2010). Sports event logistics in tourism. Opatija: Faculty of Tourism and Hospitality Management.
48. Applications of Logistics and Supply Chain Management in Travel and Tourism Industry, Scribd, 9th of February 2012.
49. Lamers, M., Haase, D., Amelung, B. (2008). Facing the elements: analysing trends in Antarctic tourism. *Tourism Review*, 63(1), pp. 15–27.
50. Martins, R., Lobo, D., Labegalini, L., De Padua Carrieri, A. (2008). Logistics Managers' Stated Preferences for Supply Management Attributes for the Case of Inns in Brazil. *An International Journal of Tourism and Hospitality Research*, 19 (2), pp. x–x.
51. Mrnjavac, E. & Ivanovic, S. (2007). Logistics and Logistics Processes in a Tourism Destination. *Tourism and Hospitality Management*, 13 (3), pp. 531–546.
52. Mrnjavac, E. (2010). Logistics management in tourism. *Tourism and Hospitality Management*, 16 (2), pp. 265–266.
53. Muchina, S. (2008). Logistics and Supply Chain Management in Tourism. *The Amfiteatru Economic Journal*, 10 (24), pp. 122–132.
54. O'Brien, D. & Ponting, J., (2013). Sustainable Surf Tourism: A Community Centered Approach in Papua New Guinea. *Journal of Sport Management*, 27 (2), pp. 158–172.
55. O'Neill, M. (2004). Wine Production and Tourism: Adding Service to a Perfect Partnership. *Cornell Hotel and Restaurant Administration Quarterly*, pp. 269–284.
56. Parroco, A. (2012). Multi-Destination Trips and Tourism Statistics: Empirical Evidences in Sicily. *Economics*, pp. 1–27A.
57. Tourism Logistics or Tourism Supply Chain Management?, Tourism logistics, 8th July 2009.
58. Radišić, B., (2007). The logistics of selling a destination's tourism product. *Tourism and Hospitality Management*, 13 (3), pp. 725–732.
59. Tourism Logistics, RMIT University, [available at: <http://www.rmit.edu.au/courses/039994>, access September 19, 2014]

60. »Logistik«, Soulforce, [available at: <http://www.soulforce.gmxhome.de/ism/Logistik>, access September 19, 2014]
61. Supply chain in tourism services UKessays.com, [available at: <http://www.ukessays.co.uk/essays/business-theory/supply-chain-in-tourism-services.php>, access September 19, 2014]
62. Schwartz, K., Tapper, R., Font, X. (2008). A Sustainable Supply Chain Management: Framework for Tour Operators. *Journal of Sustainable Tourism*, 16 (3), pp. 298–314.
63. The importance of Logistics and SCM in Tourism industry, Therm paper Warehouse, [available at: <http://www.termpaperwarehouse.com/essay-on/The-Importance-Of-Logistics-And-Scm/136241>, access September 19, 2014]
64. Thrane, C. (2005). How to present results from logistic regression analysis in hospitality and tourism research. *Tourism and hospitality Resarch*, 5 (4), pp. 295–305.
65. Yildirim, Y. & Bititci, U. (2006). Performance measurement in the value chain: manufacturing v. tourism. *International Journal of Productivity and Performance Management*, 55.5, pp. 371–389.
66. Yildirim, Y. & Bititci, U. (2006). Performance measurement in tourism: a value chain model. *International Journal of Contemporary Hospitality Management*, 18.4, pp. 341–349.
67. Zhang, X., Song, H., Huang, G. (2009). Tourism supply chain management: a new research agenda. *Tourism Management*, 30, pp. 345–358.
68. Afshar, A. & Haghani, A. (2012). Modeling integrated supply chain logistics in real -time large-scale disaster relief operations. *Socio-Economic Planning Sciences*, 46 (4), pp. 327–338.
69. Ali, A., Lee, J., Khadem, M., Seifoddini, H. Intelligent Production Scheduling for Medical Equipments in Global Logistics Environment. *Proceedings of the 13th Industrial Engineering Research Conference (IERC 2004)*, Houston, Texas, May 15-19, 2004.
70. Antai, I. & Mutshinda, C. M. (2010). Health status assessment using reverse supply chain data. *Management Research Review*, 33 (2), pp. 111–122.
71. Aptel, O. & Pourjalali, H. (2001). Improving activities and decreasing costs of logistics in hospitals: a comparison of U.S. and french hospitals. *The International Journal of Accounting*, 36 (1), pp. 65-90.
72. Azzi, A., Persona, A., Sgarbossa, F., Bonin, M. (2012). Drug inventory management band distribution: outsourcing logistics to third – party provider. *Strategic Outsourcing: An International Jornal*, 6 (1), pp. 48–64.
73. Bamford, D., Thornton, H., Bamford, J. (2009). Health-care logistics redesign. *OR Insight*, 22 (3), pp. 140–152.
74. Banomyong, R. & Sopadang, A. (2010). Using Monte Carlo simulation to refine emergency logistics response models: a case study. *International Journal of Physical Distribution & Logistics Management*, 40 (8/9), pp. 709–721.
75. Bossert, T., Bowser, D., Amenyah, J. K. (2007). Is decentralization good for logistics systems? Evidence on essential medicine logistics in Ghana and Guatemala. *Health Policy and Planning*, 22 (2), pp. 73–82.

76. Bricknell, M. C. M. & MacCormack, T. (2005). *Abc Of Conflict And Disaster: Military Approach To Medical Planning In Humanitarian Operations*. British Medical Journal, 330 (7505), pp. 1437–1439.
77. Chindove; S. & Mdege, N. D. (2012). *Logistics Data Collection and Reporting for Essential Medicines in Developing Countries: A Review*. Journal of Health Management, 14 (4), pp. 397–408.
78. Colletti, J. (1994). *Health care reform and the hospital supply chain*. Hospital Material Management Quarterly, 15 (3), pp. 28–35.
79. Crowell, F. J. (1991). *Report of industrial Commission of the Distribution of Farm products*. Washington DC: US Government Printing Office.
80. Dooley, L. (2009). *Make logistics the focus of your supply chain plan*. Materials management in health care, 18 (5), pp. 26–9.
81. Fitzgerald, J. & Dadich, A. (2009). *Using Visual Analytics to Improve Hospital Scheduling and Patient Flow*. Journal of Theoretical and Applied Electronic Commerce Research, 4 (2), pp. 20–30.
82. Germain, R., Davis-Sramek, B., Lonial, S. C. (2011). *The Impact of Relational Supplier Exchange on Financial Performance: A Study of the Hospital Sector*. Journal of Business Logistics, 32 (3), pp. 240–253.
83. Heinbuch, S. (1995). *A case of successful technology transfer to health care. Total quality materials management and just-in-time*. Journal of Management in Medicine, 9 (2), pp. 48–56.
84. Hu, J., Zeng, A. Z., Zhao, L. (2009). *A comparative study of public-health emergency management*. Industrial Management & Data Systems, 109 (7), pp. 976–992.
85. Jarrett, G. (1998). *Logistics in health care industry*. Kaiser Permanente, Altadena, California, USA.
86. Kafetzidakis, J. & Mihiotis, A. (2012). *Logistics in the Health Care System: The Case of Greek Hospitals*. International Journal of Business Administration, 3 (5), p. 23.
87. Lapierre, S. & Ruiz, A. (2005). *Scheduling logistic activities to improve hospital supply system*. Computers & Operations Research, 34(3), pp. 624–641.
88. Nordström, K., Närhi, M., Vepsäläinen, A. (2009). *Service for distribution of tissue engineering products and therapies*. International Journal of Productivity and Performance Management, 58 (1), pp. 11–28.
89. Poulin, E. *Benchmarking the hospital logistics process - A potential cure for the ailing health care sector*, [available at: <http://www.thefreelibrary.com/Benchmarking+the+hospital+logistics+process%3A+A+potential+cure+for+the...-a098953048>, access September 19, 2014]
90. Sackmann, S., Eymann, T., Müller, G.. (2002). *EMIKA - Real-Time Controlled Mobile Information Systems in Health Care Applications*. Institute of Computer Science and Social Studies, Telematics Dept., Albert-Ludwigs-University Freiburg.
91. Su, S. I., Gammelgaard, B., Yang, S. (2010). *Logistics innovation process revisited: insights from a hospital case study*. International Journal of Physical Distribution & Logistics Management, 41 (6), pp. 577–600.

92. Swinehart, K., Zimmerer, T. W., Oswald, S. (1995). Adapting a strategic management model to hospital operating strategies - A model development and justification. *Journal of Management in Medicine*, 9 (2), pp. 34–47.
93. Towill, D. R. (2006). Viewing Kaiser Permanente via the logistician lens. *International Journal of Health Care Quality Assurance*, 19 (4), pp. 296–315.
94. Van Lent, W., Sanders, E., Van Harten, W. (2012). Exploring improvements in patient logistics in Dutch hospitals with a survey. *BMC Health Service Research* 2012.
95. Van Vactor, J. (2009). A case study of collaborative communications within the U.S. army medical department logistics community. University of Phoenix.
96. Van Vactor, J. (2011). A case study of collaborative communications within healthcare logistics. *Leadership in Health Services*, 24 (1), pp. 51–63.
97. Van Vactor, J. (2011). Cognizant healthcare logistics management: ensuring resilience during crisis. *International Journal of Disaster Resilience in the Built Environment*, 2 (3), pp. 245–255.
98. Van Vactor, J. (2013). Leveraging the Patient-Centered Medical Home (PCMH) model as a health care logistics support strategy. *Leadership in Health Services*, 26 (2), pp. 95–106.
99. Villa, S., Barbieri, M., Lega, F. (2009). Restructuring patient flow logistics around patient care needs: implications and practicalities from three critical cases. *Health Care Manag Sci*, 12 (2), pp. 155–165.
100. Vries, J. & Huijsman, R. (2011). Supply chain management in health services: an overview. *Supply Chain Management: An International Journal*, 16 (3), pp. 159–165.
101. Xie, Y. & Breen, L. (2012). Greening community pharmaceutical supply chain in UK: a cross boundary approach. *Supply Chain Management: An International Journal*, 17 (1), pp. 40–53.
102. Xiong, Z. P. & Pokharel, S. (2007). Logistics in hospitals: a case study of some Singapore hospitals. *Leadership in Health Services*, 20 (3), pp. 195–207.
103. Zuckerman, A. (2006). Advancing the State of the Art in Healthcare Strategic Planning. *Frontiers of Health Services Management*, 23 (2), p. 3.
104. Andreu, R. & Sieber, S. (2001). Rally Racing: Knowledge and Learning Requirements for a Winning Team. *Knowledge and Process Management*, 8 (2), pp. 91–98.
105. Dębicki, T. (2008, november). Challenges for logistics in the pinnacle of motorsports-Formula 1. *Archives of Transport Telematics*, 1 (1), pp. 3–7.
106. Dey, P. DB Schenker To Be Actively Involved In UEFA EURO 2012, [available at: [https://www.dbschenker.com/file/1499768/data/2008\\_gb\\_dbml\\_en.pdf](https://www.dbschenker.com/file/1499768/data/2008_gb_dbml_en.pdf), access September 19, 2014]
107. DHL announced as Logistics partner, Volvo Ocean Race, [available at: [http://www.volvoceanrace.com/en/news/2974\\_DHL-announced-as-Logistics-Partner.html](http://www.volvoceanrace.com/en/news/2974_DHL-announced-as-Logistics-Partner.html), access April 29, 2013]
108. Howells, R., The Logistics Of The Olympics Is A Marathon, Not A Sprint, [available at: <http://www.forbes.com/sites/sap/2012/07/16/the-logistics-of-the-olympics-is-a-marathon-not-a-sprint/>, access April 29, 2013]



109. Khairul, A. M., A costly logistical nightmare, [available at: <http://search.proquest.com.ezproxy.lib.ukm.si/docview/748048098/13DDEDDC3455096551B/19?accountid=28931>, access April 29, 2013]
110. Liaudat, C. & Henderson, N., Large event logistical and support traffic management, [available at: <http://www.citec.ch/wp-content/uploads/2012/03/Citec-Henderson-Liaudat-02.02-SRTC2002-Large-event-logistical-and-support-traffic-management-Henderson-Nathalie.article-18.pdf>, access May 13, 2013]
111. Logistics, F1 Formula 1, [available at: [http://www.formula1.com/inside\\_f1/understanding\\_the\\_sport/5297.html](http://www.formula1.com/inside_f1/understanding_the_sport/5297.html), access May 13, 2013]
112. Minis, I., Paraschi, M., Tzimourtas, A. (2006). The design of logistics operations for the Olympic Games. *International Journal of Physical Distribution & Logistics Management*, 36 (8), pp. 621–642.
113. Nunes, E. E. F. (b. d.). Sports events logistics: comparative cases study in Germany and South Africa world Cups [available at: <http://www.bv.fapesp.br/en/bolsas/53398/sports-events-logistics-comparative-cases/>, access 2nd of May 2013]
114. Pansare, R., It's all about getting the logistics right in F1. [available at: <http://www.dnaindia.com/sport/1757299/report-its-all-about-getting-the-logistics-right-in-f1>, access April 29, 2013]
115. Paulin, M., Major Sporting Events have positive impact on Logistics. [available at: <http://theecomaorganisation.blogspot.com/2012/07/major-sporting-events-have-positive.html>, access April 29, 2013]
116. Riley, L., World cup a logistical nightmare; With 6 weeks to plan, pace has been hectic, 7 Sports final Edition, [available at: <http://search.proquest.com.ezproxy.lib.ukm.si/docview/256894157/13DDEDDC3455096551B/35?accountid=28931>, access April 29, 2013]
117. Sparks, L. (2007). Distribution channels and sports logistics. In J. G. Beech & S. Chadwick (ed.). *The marketing of sport*. Essex: Pearson Education Limited, pp. 342–365.
118. Stubbs, D., Formula One's logistical torment, [available at: <http://search.proquest.com.ezproxy.lib.ukm.si/docview/434209057/13DDE8D5506123AC506/9?accountid=28931>, access April 29, 2013]
119. Wassermann, F., World cup 2010: A question of logistics, [available at: [http://www.arena-one.com/wp-content/uploads/2012/01/10-10-31-SPONSORS\\_Sports\\_Venue\\_Report\\_2\\_2010.pdf](http://www.arena-one.com/wp-content/uploads/2012/01/10-10-31-SPONSORS_Sports_Venue_Report_2_2010.pdf), access April 29, 2013]
120. Aviles, M., Cox, S., Rutner, S. M. (2012). Logistics evolution: a comparison of military and commercial logistics thought. *International journal of Logistics management*, 23 (1), pp. 96–118.
121. Bender, A., Billington, J., Francis, B., Gallasch, G. E., Lilith, N., Zhang, L. (2008), Modeling defence logistics networks, *Int. J. Software Tools Technological Transfer* 10, pp. 75–93.
122. Bosotina, V. & Podbregar, I. (2007). *Vojaška logistika*. Celje: Fakulteta za logistiko.



123. Button, K., Vega, H., Nijkamp, P. (2010). *A Dictionary of Transport Analysis*. U. K.: Edward Elgar Publishing Limited.
124. Carrico, T. & Greaves, M. (2007), *Agent Applications in Defence Logistics*, Whitestein Series in Agent Technologies, pp. 51–72.
125. Carter, R., Worrall, R., Beans, B., Ellsworth, E. (1954). *Ships, Salvage and the Sinews of War*. Washington: US NAVY.
126. Craig M. Brandt. (2005). *The Fundamentals of Military Logistics*. Wright-Patterson Air Force Base, OH: Defense Institute of Security Assistance.
127. Eccles H. (1959). *Logistics in the National Defense*. Harrisburg: Stackpole Company.
128. Eßig, M., Glas, A., Hofmann, E. (2013), Performance-based logistics: a portfolio for contracting military supply. *International Journal of Physical Distribution & Logistics Management*, 43 (2), pp. 97–115.
129. Gluck., F. (1982). Perspectives in security assistance management; Military logistics and the need for understanding. *Logistics Spectrum: Journal of the Society of Logistics Engineers*.
130. Gropman, A. (1997). *American Logistics in World War II*. Washington DC: National Defense University Press.
131. Gue, K. R. (2003), A dynamic distribution model for combat logistics. *Computers & Operations Research*, 30, (3), pp. 367–381.
132. Hallin, W. P. (1997). *Agile Combat Support*. Air Force Journal and Logistics.
133. Henderson, H. J. (2011). *The So What Factor of Logistics: The Science and Art of Military Logistics*. Indiana: AuthorHouse.
134. Huston, J. A. (1988). *Outposts and Allies: U.S. Army Logistics in the Cold War, 1945 – 1953*.
135. Jean-Paul R. Brian S. (2002). *Logistics and National Security*. Pennsylvania: Academy of Science.
136. Jie, W., Wen, W. (2012). *Research on 6R Military Logistics Network*. China: Hebei University of Technology.
137. Jomini, A. H. (1838). *The Art of War*.
138. Kane, M. T. (2001). *Military Logistics and Strategic Performance*. New York: Routledge.
139. Kevin R. G. (2003). *A dynamic distribution model for combat logistics*. U. S. A.: Naval Postgraduate School.
140. Kress, M. (2002). *Operational Logistics: The art and science of sustaining military operations*.
141. Molana, H. M. (2009), *Supply Chain and Logistics in National, International and Governmental Environment*, *Contributions to Management Science*, pp. 253–278.
142. Schrad, D. & Wadsworth, D. (1991), *naval Combat Logistics Support System*. *J. Opl. Res. Soc.*, 41 (11), pp. 941–984.
143. NATO Standardization Agency (NSA) (2009). APP6, NATO glossary of terms and definitions.
144. Piggee, F. A. (2002). *Transformation – revolution in military logistics*. Carlisle: US Army War College.

145. Prebilič, V. (2006). *Vojaška logistika: teorija in zgodovina*. Ljubljana: Fakulteta za družbene vede.
146. Pujo, P. & Ounnar, F. (2006). Evaluating suppliers within a self – organized logistical network. *International Journal of Logistics Management*.
147. Richard, B. (1999). *Dictionary of Military Terms*. Middlesex (GB): Peter Collin Publishing.
148. Rutner, S., Aviles, M., Cox, S. (2012). Logistics evolution: a comparison of military and commercial logistics thought. *International Journal of Logistics Management*, 23 (1), pp. 96–118.
149. Rainey, C. J. & Scott, B. F. (2004). *Logistics Dimensions*. Air Force Journal of Logistics, 29 (1), pp. x–x.
150. Schrady, D. & Wadsworth, D. (1991). Naval Combat Logistics Support System. *The Journal of the Operational Research Society*, 42 (11), pp. 941–948.
151. Scott, B. F., Rainey, C. R., Hunt, A. W. (2000). *The Logistics of War*. Alabama: Air Force Logistics Management Agency.
152. Scott, B. F., Rainey, C. R., Waller G. (2002). *Logistics Dimensions*. Alabama: Air Force Logistics Management Agency.
153. Singh A. K., Kundu S. C., Singh S. (1998), *Logistics Management*. New Delhi: Mittal Publications.
154. Thorpe, G. C. (1986). *Thore's Pure Logistics: The Science of War Preparation*, new ed., with an introduction by Stanley L. Falk.
155. U.S. Marine Corps. (1997). *Logstics*. Washington DC: Department of the Navy Headquarters United States Marine Corps.
156. Van Creveld, M. (2005). *Supplying War: Logistics from Wallenstein to Patton*. U.K.: Cambridge University.
157. Apte, A. (2010). *Humanitarian Logistics: A New Field of Research and Action*. Hanover: USA.
158. Antosia R. E., Disaster logistics, [available at: [http://link.springer.com.ezproxy.lib.ukm.si/content/pdf/10.1007%2F978-0-387-32804-1\\_5.pdf](http://link.springer.com.ezproxy.lib.ukm.si/content/pdf/10.1007%2F978-0-387-32804-1_5.pdf), access May 5, 2013]
159. Bonney J., *The Journal of Commerce*. The ultimate logistics challenge. [available at: [http://www.fritzinstitute.org/PDFs/InTheNews/2003/JOC\\_120803.pdf](http://www.fritzinstitute.org/PDFs/InTheNews/2003/JOC_120803.pdf), access May 5, 2013]
160. Carroll A. & Neu J., (2009). Volatility, unpredictability and asymmetry: An organising framework for humanitarian logistics operations? *Management Research News*, 32 (11), pp. 1024–1037.
161. Chandes, J. & Pache, G. (2010). Investigating humanitarian logistics issues: from operations management to strategic action. *Journal of Manufacturing Technology Management*, 21 (3), pp. 320–340.
162. Christopher, M. & Tatham, P., *Humanitarian Logistics: Meeting the Challenge of Preparing for and responding to disasters*, [available at: <http://books.google.si/books?id=lq4FI4rkiIkC&printsec=frontcover&dq=humanitarian+logistics&hl=sl&sa=X&ei=B06JUbaUAoGjO5yMgagF&ved=0CDkQ6AEwAQ#v=onepage&q=humanitarian%20logistics&f=false>, access May 5, 2013]

163. Costa S. R. A. , Campos V. B. G., Mello Bandeira R. A., (2012), Supply Chains in Humanitarian Operations: Cases and Analysis. *Procedia - Social and Behavioral Sciences*, 54 (4), pp. 598–607.
164. Cozzolino A. Humanitarian Logistics, *SpringerBriefs in Business*, [available at: [http://link.springer.com.ezproxy.lib.ukm.si/content/pdf/10.1007%2F978-3-642-30186-5\\_2.pdf](http://link.springer.com.ezproxy.lib.ukm.si/content/pdf/10.1007%2F978-3-642-30186-5_2.pdf), access May 5, 2013]
165. Dasaklis T. K., Pappis C. P., Rachanioti, N. P. S., (2012). Epidemics control and logistics operations: A review. *International Journal of Production Economics*, 139 (2), pp. 393–410.
166. Day, J. M., Melnyk, S. A., Larson, P. D., Davis, E. W., Whybark D. C. (2012, april). Humanitarian and disaster relief supply chains: a matter of life and death. *Journal of Supply Chain Management*, 48 (2), pp. 21–36.
167. Gustavsson L. Humanitarian logistics: context and challenges. Logistics and supply chain management underpin responses to humanitarian crises, [available at: <http://www.fmreview.org/en/FMRpdfs/FMR18/fmr1803.pdf>, access September 19, 2014]
168. Heaslip G., Sharif A., Althonayan M.A. (2012). Employing a systems-based perspective to the identification of inter-relationships within humanitarian logistics. *International Journal of Production Economics*, 139 (2), pp. 377–392.
169. Ichoua S. Humanitarian Logistics Network Design for an Effective Disaster Response, [available at: <http://www.iscram.org/ISCRAM2010/Papers/269-Ichoua.pdf>, access September 19, 2014]
170. Jahre M., Jensen, L.M., Listou, T. (2009). Theory development in humanitarian logistics: a framework and three cases. *Management Research News*, 32 (11), pp. 1008–1023.
171. Kovacs G. & Spens. M. K., (2011), Humanitarian logistics and supply chain management: the start of a new journal. *Journal of Humanitarian Logistics and Supply Chain Management*, 1 (1), pp. 5–14.
172. Pedraza Martinez, A. J. & Van Wassenhove, L. N. (2013). Vehicle Replacement in the International Committee of the Red Cross. *Production and operations management*, 22 (2), pp. 365–376.
173. Smirnov A. et. al., Context-Driven Information Fusion for Operational Decision Making in Humanitarian Logistics, [available at: [http://link.springer.com.ezproxy.lib.ukm.si/content/pdf/10.1007%2F978-3-540-37629-3\\_5.pdf](http://link.springer.com.ezproxy.lib.ukm.si/content/pdf/10.1007%2F978-3-540-37629-3_5.pdf), access September 19, 2014]
174. Van Wassenhove, L. N. & Pedraza Martinez, A. J. (2010). Using OR to adapt supply chain management best practices to humanitarian logistics. *International transactions in operational research*, 19, pp. 307–322
175. Veras J. H., Jaller M., Wassenhove L.N. V., Perez N., Wachtendorf, T. (2012). On the unique features of post-disaster humanitarian logistics. *Journal of Operations Management*, 30 (7-8), pp. 494–506.
176. Zanjirani Farahani R., Asgari, N., Davarzani, H. (2009). Supply Chain and Logistics in National, [available at: [http://link.springer.com.ezproxy.lib.ukm.si/content/pdf/10.1007%2F978-3-7908-2156-7\\_10.pdf](http://link.springer.com.ezproxy.lib.ukm.si/content/pdf/10.1007%2F978-3-7908-2156-7_10.pdf), access September 19, 2014]



## LOGISTICS ASPECTS OF FIRMS' CAPABILITIES TO INCREASE INTERNATIONAL COMPETITIVENESS

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*Scientific paper*

### ***Abstract***

The elimination of a great number of trade barriers between countries in recent decades as well as some considerable changes in the supply and demand in different parts of the world have brought a tremendous growth in trade relationships between countries and regions and have led to an increase of international competition in nearly all industries. The enlargement of firms' logistics systems on a continental and global scale and the associated increased complexity of logistics processes have increased the importance of the development of adequate logistics capabilities, not only to ensure access to the new markets and supply sources but also to increase competitiveness through reduction of logistics costs and improvement of customer service. The current paper utilizes this idea of the development of adequate logistics capabilities as the basis for evaluating firms' perceived competitiveness. In particular, the study examines the logistics aspects of the strengths and weaknesses of Bulgarian manufacturing firms servicing foreign markets, the extent of invested resources in information systems and technologies facilitating integration of material and information flows, as well as planned actions to improve their capabilities in order to increase their competitiveness in foreign markets. The results reveal the existence of linkages between some logistics capabilities and the international competitiveness of companies.

**Key words:** logistics, supply chain, competitiveness, information systems, international markets

### **1. INTRODUCTION**

During the second half of the 20<sup>th</sup> century a number of interconnected social, economic and political phenomena led to the development of globalization. From an economic point of view, globalization means growth, on an international scale, of business activities, competition and markets, as well as increased interdependence of national economies and markets, resulting in global integration of goods, capital and human resources markets (Stonehouse et al., 2004, p. 5). On a micro economic level, globalization involves global coordination and integration of firms' international

activities, encompassing not only their export/import activities but also their international manufacturing operations and transfer of technology and capital.

Undoubtedly globalization is involving an increasing number of enterprises and is bringing to the forefront specific and complex problems which complicate logistics systems. Some of the factors generating risk and uncertainty are the great geographical distances, political changes, currency fluctuations, inflation in some countries, and natural disasters. These factors have a considerable effect on logistics costs. Another characteristic feature of international logistics systems is that besides the main players (exporters and importers) they also include a number of participants that facilitate the movement of material and information flows - logistics service providers, insurance companies, inspection and verification companies, customs and other governmental institutions. The addition of more participants and links in the international supply chain (SC) increases the complexity of logistics activities, the difficulties in coordination in view of the great geographical distances and different time zones, the operational risks, and the associated costs. These costs are related to losses as a result of operational problems concerning people, processes and technologies. Such problems include fraud, inadequate computer systems, poor management control of firms' activities, working mistakes, and ignorance of procedures (Crouhy et al., 2006, p.14).

The development of firms' capabilities for solving the specific problems resulting from the international environment reveals opportunities for increasing competitiveness, not only in foreign but in domestic markets too. Capabilities are an element of the contemporary view of firms' resources; they are tools for strategic management and for defining the process of organizational growth. In contrast to the classical view of firms' resources, which considers them from an economic standpoint and is based on the aim of maintaining a sustainable competitive advantage through the achievement of larger income from possessed resources such as labour and capital, the contemporary view focuses on capabilities as a mix of two or more organizational, technological, human, physical or financial resources. Whether the standpoint is economic or strategic, according to the resource-based view the tangible and intangible organizational resources constitute the firms' key competences and influence the acquisition and maintenance of competitive advantage. Resources that are part of the key competence should be valuable, rare, and hard to copy or replace (Kraaijenbrink et al., 2010, p. 350).

This paper starts with a literature review of the issues related to firms' capabilities and their links with competitiveness, and then discusses the logistics aspects of the strengths and weaknesses of Bulgarian exporting manufacturers, the extent of their invested resources in logistics information systems and technologies, as well as their planned actions to improve international competitiveness. Conclusions are drawn about those logistics capabilities which are associated with higher competitiveness in foreign markets.

## 2. LITERATURE REVIEW

Capabilities can be defined as high-level learned routines that confer upon a firm's management a set of decision options for converting inputs into outputs, typically combining both tangible and intangible resources (Winter, 2003, p. 991). Distinctive logistics capabilities are firm's critical strategic resources that provide a competitive advantage and contribute to the firm's overall performance (Lynch et al., 2000, p. 48). Research into logistics theory and the measures used in empirical surveys reveals that the subject of logistics is mostly viewed from two aspects: internal and external. The first one is associated with the extent of integration of the material and other related flows within the company, and the second one reflects the nature of the relationships between SC members, i.e. the extent of cooperation between them concerning the management of flows. Capabilities relevant for managing SCs are basically technical and relational. Technical ones are the organizational routines based on the science and technology involved in producing and sourcing goods and services, while relational capabilities are associated with designing contractual and informal mechanisms to facilitate coordination, collaboration, knowledge transfer, and adaptation across the SC (Parmigiani et al., 2011, p. 214). Since the most important barriers that hamper the SC collaboration are power domination and inadequate recognition of the sharing of risks and benefits (Grzybowska, 2011, p. 54), relational capabilities, which are reflected in aligned incentives, shared information, increased commitment, and common goals between the firm and other entities, receive ever increasing attention.

Lia and Linb further suggest that global logistics competence is an important strategic asset that firms need to compete in the current global environment, and building it poses a major challenge for them (Li & Lin, 2006, p. 334). The authors find out that resource integration and IT infrastructure capacities are positively associated with global logistics competence. This means that using the latest information and communication technologies to link global SC members is not the only constituent of global logistics competence. It is much more important to effectively manage the relationships with all SC partners because of their interdependence, resulting from various resource flows throughout the SC. Consequently, the operational capability to manage this interdependence is crucial. Some studies indicate that coordination and configuration of functional activities are two important capabilities enabling firms to do that (Lin & Hsieh, 2010, p. 53). Reiter et al. focus essentially on the interfaces between manufacturing and logistics systems along global SCs. They argue that the balanced and stable integration of manufacturing and logistics through appropriately utilizing logistics information in the manufacturing systems can result in cost and lead time savings (Reiter et al., 2010, p. 216). Another study proposes that in an attempt to improve the interaction with foreign counterparts, firms are paying increasing attention to search, evaluation and monitoring processes as part of the management of international relationships. This represents a complex and demanding task in view of the various business contexts and partner companies (Pagano, 2009, p. 910).

Research has increasingly contributed to an improved understanding of the capabilities a company has to possess in order to gain a competitive advantage.

Many studies reveal that more organizations use information technology (IT) to improve the SC process. Wu et al. assert that IT-enabled SC capabilities are firm-specific and hard-to-copy across organizations (Wu et al., 2006, p. 493). Youn et al. show the positive influence of SC information capabilities on competitive advantage for the firm (Youn et al., 2014, p. 378). Moreover, it is important for firms to sustain information quality in the context of mutual trust, so that information is effectively used for positive performance impact. The authors conclude that firms may accomplish both customer responsiveness and cost reductions through SC flexibility based on widespread implementation of information capabilities and trust-based information sharing practices among SC partners. Another study shows that IT-enabled sharing capability has a direct impact on the firm's SC flexibility, which includes a firm's product development, production and logistics, suppliers' and supply base flexibilities. In turn, the firm's SC flexibility influences the firm's competitive advantage and ultimately the firm's competitive performance. This finding suggests that a firm should focus on flexibility in the SC to improve its performance (Jin et al., 2014, p. 29). Kisperska-Moron and Swierczek also found from a survey of the agile capabilities of Polish companies that the main factors contributing to the agility of companies and their respective SCs are relationships with business partners, IT technology, and relations with competitors (Kisperska-Moron & Swierczek, 2009, p. 224). New technologies contribute to high flexibility because they allow continuous comparison of forecasts with real demand, allowing timely identification of discrepancies and control of material flows in the system (D'Souza & White, 2006, p. 31). In short, information-based capability is one of the logistics capabilities which is most valuable because it can help organizations increase the value-added and minimize costs. Information should be shared with SC partners to improve flexibility and maintain long-term superior logistics performance which, in turn, leads to better performance (Shang & Marlow, 2005, p. 228.).

The characteristics of information and communication systems in the international environment depend on the technological infrastructure in different countries and the ability of SC members to invest in contemporary solutions. For example, in North America and Western Europe, the implementation of systems contributing to the integration of material and information flows started in the 60s and by the end of the 90s, many companies in these regions had implemented ERP systems (Easton & Zhang, 2002). In most Asian and Eastern European countries, firms are less prone to invest in such systems mostly due to a lack of skills, infrastructural problems and general reluctance to invest in intangible resources. That is why it is not surprising that costs are higher and delivery reliability is lower in comparison to companies in North America and Western Europe.

Concerning the logistics capabilities of small and medium enterprises (SMEs) we should point out that traditionally the owner-managers take logistics decisions, and in order to perform this task effectively they require explicit knowledge and skill-sets. Nevertheless they may not possess those skills, and qualified professionals are not employed in the business due to its limited size and the ownership mindset. There is proof that companies which have professional management have higher SCM capability compared to those companies which do not have professional



management (Jayaram et al., 2014, p. 482). Further analyses show that IT infrastructure and information system (IS) capability play important roles as key attributes. Also, a set of dynamic capabilities enables internationally-oriented SMEs to develop knowledge-intensive products, paving the way for their accelerated market entry (Weerawardena et al., 2007, p. 294). According to the study of Eriksson et al. this ability set includes cognitive, managerial, and organizational capabilities (Eriksson et al., 2014, p. 169). Cognitive capabilities represent cultural awareness, entrepreneurial orientation, and a global mindset, which are crucial for opportunity recognition and exploitation. Organizational flexibility and managerial capabilities in the areas of interface competence and analytical capability are needed for the steering of international SMEs.

We can summarize that the capability to manage international logistics activities in a way to balance the required customer service level and the costs of providing it is one of the leading factors associated with gaining competitive advantage. As a result of developing this capability, firms can increase the number of their potential markets and sources of supply on a continental and global scale, which has been one of the leading trends in logistics for the last 30 years. While previous studies have made a considerable contribution to the logistics capability literature, some issues remain to be studied. Therefore, in an effort to enrich the logistics capability literature the present research reports the results from a study investigating the logistics capabilities of firms in order to determine how these capabilities help to increase the international competitiveness.

### 3. METHODOLOGY

The assessment of the logistics aspects of firms' capabilities to increase international competitiveness is done on the basis of data collected from Bulgarian exporting companies through personal interviews using questionnaires with predominantly structured questions. The research includes 94 manufacturing export companies; 58.6% of them represent light industry, 17.2% - heavy industry, 8% - the high technology sector, 4.6% - mining, and the rest represent other industries including telecommunication, agriculture and construction. Concerning the number of employees, 86.8% of the respondents are SMEs.

In investigating logistics capabilities related to the increase of international competitiveness, this article specifically addresses the following: the strengths and weaknesses of Bulgarian exporting manufacturers in terms of their competitiveness, the extent of invested resources in information systems and technologies facilitating the integration of material and information flows, and planned actions to increase competitiveness in foreign markets. Since these are qualitative attributes, the methods for their assessment include the development of 5-point scales and calculation of the means of the responses for the items measuring these attributes. Significant differences in means are examined between two categories of exporters in terms of company size – large enterprises (LEs) and SMEs.

#### 4. RESULTS AND DISCUSSION

Understanding the importance that firms attach to their strengths or weaknesses allows the assessment of their capabilities to compete in foreign markets. The results in Table 1 show that six capabilities, led by the provision of high quality, are assessed highly as strengths since they receive means around and over 4 (1 - serious weakness, 5 - great strength). Among these six capabilities is the provision of quick and reliable delivery, which is a logistics capability and as such is viewed as a strength by nearly 70% of the firms. The fact that almost half of the firms (47.7) have determined as their strength the geographical proximity to markets, and that most of them service the European market does not diminish the need to develop a capability for quick and reliable delivery.

At the forefront are also such strengths as long-lasting relationships with customers/suppliers, and the firm's reputation. Their high valuations (4.1 and 3.9 respectively) show that there are prerequisites for collaboration between SC members and for the application of SC management practices. Moreover, an undisputable necessity for competing in foreign markets is to have well-developed management skills, including those connected with the movement and storage of material flows, and this is proved by the results – current management skills of the firms are assessed highly by 71% of them.

The fact that price is not among the leading strengths and is rated after quality, relationships with customer/suppliers and the characteristics of delivery, shows that most of the interviewed firms are oriented towards differentiation strategy and possibly a considerable number of firms use logistics as a competitive weapon.

It is disturbing that around 60% of the firms determine the availability of an appropriate information system as their weakness (means under 3). It can be concluded that nearly 2/3 of the firms need to update their information systems in order to increase their international competitiveness. Furthermore, partnering with similar firms is assessed with the lowest score (2.9), which means that horizontal cooperation with the aim of combining resources and capabilities in serving foreign markets is a rare phenomenon.

The absence of statistically significant differences between LEs and SMEs for most indicators speaks for their unanimity concerning the importance of the different capabilities for international competitiveness. There are differences only in relation to the experience in servicing foreign markets (including its duration and number of markets), which understandably is assessed higher by LEs.

Table 1 Logistics aspects of the strengths and weaknesses.

Strengths and weaknesses	Responses 4-5 (%)	Mean	Groups	Group's mean
Quality of products	82.6	4.2		
Long-lasting relationships with customers	80.2	4.1		
Firm's reputation	77.9	4.1		
Long-lasting relationships with suppliers	75.6	3.9		
Management skills	70.9	3.9		
Quick and reliable delivery	68.6	3.9		

International experience***	69.8	3.8	SME	3.5
			LE	4.4
Price of products	66.3	3.8		
Qualification of personnel	67.4	3.7		
Contemporary technology	65.1	3.7		
Sufficient production capacity	66.3	3.7		
Variety of products	55.8	3.6		
Financial stability	57.0	3.5		
Long experience in servicing foreign markets**	56.5	3.4	SME	3.2
			LE	4
Geographical proximity to markets	47.7	3.3		
Information system	39.5	3.2		
Experience in servicing a large number of foreign markets***	40.0	3.0	SME	2.6
			LE	3.8
Partnerships with similar firms	35.3	2.9		

\*\*\* Statistically significant difference at  $p < 0.001$

\*\* Statistically significant difference at  $p < 0.01$

The figures in Table 2 show the extent of invested resources (financial, human, time) in information systems and technologies facilitating the integration of material and information flows (1 - no resources invested; 5 - considerable resources invested). These figures also provide evidence that firms determine their current IT capabilities as being lower than necessary. They try to overcome this disadvantage with investments in software, production automation, information systems integrating purchasing, production and distribution, and warehouse management systems (means over 3). Bearing in mind that one of the most important indications for logistics capabilities is an information system that integrates purchasing, production and distribution, the fact that this area has attracted investment in 47% of the firms is at first sight a positive sign. Since the volume of data exchanged between the three functional areas is significant, it implies the usage of computers. There are also some non-computer systems as is the case with just-in-time manufacturing based on the pull approach, which however is implemented by just ¼ of the firms. As for the computerized systems contributing to the internal integration, they are actually not well embedded in the Bulgarian business practice – systems like ERP, DRP, MRP and Intranet are characterized by comparatively low means, under 3. Even lower (under 2.5) are the scores for the IT capabilities contributing to higher inter-organizational integration and effective management of material and information flows in SC. Such IT capabilities include integrating the information systems with customers and suppliers, WEB-based catalogues, point-of-sales (POS) systems and satellite systems for delivery tracing.

Comparative analysis reveals that LEs invest more resources in systems integrating the material flow (ERP, DRP, MRP), i.e. their investments in software are not in isolated management areas but aim at achieving well developed integration capabilities.

Table 2 Invested resources in information systems and technologies

<b>Invested resources in information systems and technologies</b>	<b>Responses 4-5 (%)</b>	<b>Mean</b>	<b>Groups</b>	<b>Group's mean</b>
Production automation	56.0	3.6		
Software**	57.0	3.6	SME	3.4
			LE	4.2
Information system integrating purchasing, production and distribution	46.5	3.2		
Warehouse management system	36.7	3.0		
Enterprise resource planning system (ERP)**	36.0	2.8	SME	2.5
			LE	3.3
"Just-in-time " system	26.5	2.5		
Material requirements planning system (MRP)**	23.8	2.4	SME	2.2
			LE	3.0
Intranet system	27.1	2.4		
Integration of the information system with main customers and suppliers	22.4	2.4		
WEB-based catalogues	28.2	2.3		
Distribution requirements planning system (DRP)**	20.9	2.2	SME	1.9
			LE	2.7
Point-of-sales (POS) system	14.1	2.1		
Satellite system for delivery tracing	11.6	1.6		

\*\*Statistically significant difference at  $p < 0.01$ .

Since the achievement of high competitiveness in foreign markets is a complex and difficult task, the research also considers actions that firms will take to overcome the challenges in the international environment. Actions in two basic areas are examined - products and management system, using the scale "1- no actions will be taken, 5 – considerable number of actions". Data in Table 3 show that firms' efforts in the products area will be focused mainly on the continuing improvement of quality, and to a lesser extent on increasing the variety of products and decreasing the costs of their production, which proves the orientation of Bulgarian exporting manufacturers towards a differentiation strategy. Quality is considered as the most apparent competitive product characteristic and because of that it exerts great influence on customer satisfaction, so it is not surprising that 71.8% of the researched firms intend to take actions aimed at its improvement.

qualification (nearly 4), which is identified by around 1/3 of them as a weakness. This is an acknowledgement that personnel are an essential factor for firms' success.

There is a strong relation between logistics capabilities and actions, such as increasing service levels, implementing information systems, improving the speed and reliability of deliveries and developing capabilities for a wider geographical scope. These actions are considered by more than half of the firms and have mean scores of 3.5 or more. Since these actions are closely related to logistics, this result points to the importance that firms attach to logistics as a factor associated with increased competitiveness, especially the role of information systems. It should be

considered that results in table 1 show that information systems are not determined as a particular strength in comparison with other areas, so apparently there is awareness among firms of the need to invest more resources in this area.

Table 3 Planned actions to improve firms' capabilities.

Planned actions to improve firm's capabilities	Responses 4-5 (%)	Mean	Groups	Group's mean
Improve quality	71.8	4.1		
Increase qualification of personnel	71.0	3.9		
Increase service levels for foreign customers*	63.5	3.7	SME	3.5
			LE	4.1
Increase the variety of products	65.1	3.7		
Implement new production technologies	60.5	3.7		
Decrease costs	61.6	3.6		
Implement information systems**	58.1	3.5	SME	3.3
			LE	4.1
Improve the speed and reliability of deliveries	58.8	3.5		
Develop capabilities for a wider geographical scope**	53.5	3.5		
			SME	3.2
			LE	3.9
Develop SCM capabilities*	47.7	3.2	SME	3.0
			LE	3.6
Develop capabilities for integration of international activities	47.7	3.2		
Improve promotional activities**	34.9	3.0		
			SME	2.8
			LE	3.4

\*\* statistically significant difference at  $p < 0.01$ .

\* statistically significant difference at  $p < 0.05$ .

A future priority for the firms will be the improvement of human resources

The development of capabilities for integration of international activities and SC management capabilities is assessed lower (3.2), which shows that some firms do not realize the contribution of these capabilities to the improvement of service, the delivery characteristics and the expansion of the geographical scope (¼ of the respondents state that their firms will take no action along these lines). The development of these capabilities also requires contemporary information systems and technologies since the open communication in the SC is an accelerator of integration. Some of the firms consider the absence of qualified personnel as a barrier to the improvement of SC management capabilities, which emphasizes again the importance of human resources for competitiveness.

The assessment of the statistically significant differences between SMEs and LEs reveals that the latter place great emphasis on the increase of service levels for foreign customers, the development of capabilities for a wider geographical scope, and SC management capabilities. Obviously, LEs realize that all of these objectives can be achieved through the implementation of contemporary information systems.

## 5. CONCLUSION

Internationalization of firms' activities leads to more complex logistics systems and the need to integrate domestic and international logistics processes, which is not an easy task and requires the development of international logistics capabilities. The research results reveal that the capabilities that Bulgarian exporting manufacturers assess as important for their success in foreign markets are those that are predominantly differentiating in their nature, and amongst them, besides quality, are the provision of quick and reliable deliveries, and long-lasting relationships with other SC members. At the same time, while information systems should be used as powerful tools for facilitating logistics management and thus increasing competitiveness, their current state in Bulgarian firms is inadequate. The most frequently stated reason for that is the lack of resources for the implementation of the necessary technologies and systems. Nevertheless, firms are aware of the need to refine this area since their plans for future actions for increasing foreign competitiveness include the improvement of the state of the information systems, as well as a greater focus on quality, speed, reliability of deliveries and customer service.

The research also reveals that SMEs lag behind LEs in the development of capabilities for servicing foreign markets, which is due to their more limited experience. This lag stands out mostly in relation to the invested resources in integrating the material flows systems. It is alarming that they have less interest in improving in this direction, in increasing foreign customer service levels, or in developing SC management capabilities. Apparently, the implementation of the logistics principles and methodologies in management remains a challenge for SMEs, bearing in mind the complex flows of goods and information. Future research should examine the factors, besides limited resources, leading to this lag affecting SMEs and should formulate specific guidelines for them to overcome it with the aim of increasing their competitiveness in foreign markets.

## 6. REFERENCES AND SOURCES OF INFORMATION

1. Crouhy, M., Galai, D., Mark, R. (2006). *Essentials of Risk Management*, McGraw-Hill.
2. D'Souza, E. and White, E. (2006). *Demand Forecasting for the Net Age: From Thought to Fulfillment in One Click*. In Lan, Y. and Unhelkar, B., (ed.). *Global Integrated Supply Chain Systems*, Idea Group Inc., pp. 29-47.
3. Easton, R. and Zhang, T. (2002). *Supply Chains in Asia: Challenges and Opportunities*, Supply Chain Perspectives, Acenture.
4. Eriksson, T., Nummela, N., Saarenketo, S. (2014). Dynamic Capability in a Small Global Factory, *International Business Review*, 23, pp. 169-180.
5. Grzybowska, K. (2011). *Modelling the Barriers of Global Supply Chain*. In Grzybowska, K., (ed.). *Management of Global and Regional Supply Chain - Research and Concepts*, Publishing House of Poznan University of Technology, pp. 41-58.

6. Jayaram, J., Dixit, M., Motwani, J. (2014). Supply Chain Management Capability of Small and Medium Sized Family Businesses in India: A Multiple Case Study Approach, *Int. J. Production Economics*, 147, pp. 472–485.
7. Jin, Y., Vonderembse, M., Ragu-Nathan, T.S., Smith, J.T. (2014). Exploring Relationships among IT-enabled Sharing Capability, Supply Chain Flexibility, and Competitive Performance, *Int. J. Production Economics*, 153, pp. 24–34.
8. Kisperska-Moron, D. and Swierczek, A. (2009). The Agile Capabilities of Polish Companies in the Supply Chain: An Empirical Study, *Int. J. Production Economics*, 118, pp. 217–224.
9. Kraaijenbrink, J., Spender, J.C., Groen, A.J. (2010). The Resource-Based View: A Review and Assessment of its Critiques, *Journal of Management*, 36 (1), pp. 349–372.
10. Li, P. and Lin, B. (2006). Building Global Logistics Competence with Chinese OEM Suppliers, *Technology in Society*, 28, pp. 333–348.
11. Lin, S.L. and Hsieh, A.T. (2010). International Strategy Implementation: Roles of Subsidiaries, Operational Capabilities, and Procedural Justice, *Journal of Business Research*, 63, pp. 52–59.
12. Lynch, D.F., Keller, S.B., Ozment, J. (2000). The Effects of Logistics Capabilities and Strategy on Firm Performance, *Journal of Business Logistics*, 21(2), pp. 47–67.
13. Pagano, A. (2009). The Role of Relational Capabilities in the Organization of International Sourcing Activities: A Literature Review, *Industrial Marketing Management*, 38, pp. 903–913.
14. Parmigiani, A., Klassen, R.D., Russo, M.V. (2011). Efficiency Meets Accountability: Performance Implications of Supply Chain Configuration, Control, and Capabilities, *Journal of Operations Management*, 29, pp. 212–223.
15. Reiter, B.S., Frazzon, E.M., Makuschewitz, T. (2010). Integrating Manufacturing and Logistics Systems along Global Supply Chains, *CIRP Journal of Manufacturing Science and Technology*, 2, pp. 216–223.
16. Shang, K. and Marlow, P.B. (2005). Logistics Capability and Performance in Taiwan's Major Manufacturing Firms, *Transportation Research*, Part E, 41, pp. 217–234.
17. Stonehouse, G., Campbell, D., Hamill, J., Purdie, T. (2004). *Global and Transnational Business: Strategy and Management*, John Wiley and Sons.
18. Weerawardena, J., Mort, G.S., Liesch, P.W., Knight, G. (2007). Conceptualizing Accelerated Internationalization in the Born Global Firm: A Dynamic Capabilities Perspective, *Journal of World Business*, 42, pp. 294–306.
19. Winter, S.G. (2003). Understanding Dynamic Capabilities, *Strategic Management Journal*, 24, pp. 991–995.
20. Wu, F., Yenyurt, S., Kim, D., Cavusgil, S.T. (2006). The Impact of Information Technology on Supply Chain Capabilities and Firm Performance: A Resource-Based View", *Industrial Marketing Management*, 35, pp. 493 – 504.
21. Youn, S.H. Yang, M.G., Kim, J.H., Hong, P. (2014). Supply Chain Information Capabilities and Performance Outcomes: An Empirical Study of Korean Steel Suppliers, *International Journal of Information Management*, 34 (3), pp. 369–380.





## **EFFICIENCY ANALYSIS OF CARGO TRAM FOR CITY LOGISTICS COMPARED TO ROAD FREIGHT TRANSPORTATION: A CASE STUDY OF ISTANBUL CITY**

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*Professional paper*

### ***Abstract***

In recent years, changes relating to logistics approaches have been observed. Logistics activities at a micro level have begun to gain an importance compared to logistics activities at the macro level although global logistics are still important. Urban logistics, also known as city logistics, has come to gain an importance for regional and global actors of logistics and supply chains. While the economic costs were the most important concept in the past, nowadays, external costs have become an important factor in addition to the economic cost of logistics. Not only improved logistics operations but also environmentally-friendly logistics activities are promoted by local authorities, international institutions and governments. Regulations related to green logistics are being put into effect by these actors. Logistics operators and actors are seeking new operation alternatives for more effective, productive and environmentally-friendly logistics and transportation operations.

Cargo trams can provide effective solutions for urban logistics problems. Cargo trams which use urban passenger transportation tram lines can be beneficial and important instruments to solve urban logistics problems. Road transportation plays a key role in causing city logistics problems. When traffic congestion, environmental and air pollution, casualties and injuries caused by road accidents are considered, we see there are significant detrimental results to road transportation. If the share of road transportation can be reduced, these detrimental results can be reduced. One of the beneficial ways of solving this problem is to reduce the number of road vehicles entering the center of the city. In order to reduce road transportation in urban areas, the use of cargo trams can provide numerous advantages in urban freight transportation. During the day, cargoes can be carried with these vehicles as one or more cargo wagons added to the passenger tram. At night, when it is not used for passenger transportation, it can be used more intensively. When cargo trams' use is increased in urban areas, emissions, accidents, loss of life and other detrimental results can be reduced. In this study, impacts of cargo trams on urban logistics system are evaluated in terms of costs and benefits. Furthermore, reduction in the external costs of transportation are described in the use of cargo trams in urban areas. In this paper, urban logistics activities in Istanbul city were selected as a case

study. Attainable potential advantages of using cargo trams on available passenger tram lines are defined in comparison with road transportation.

**Key words:** Urban Logistics, Cargo Tram, Freight Transportation, Cost-Benefits Analysis

## 1. INTRODUCTION

City logistics has gained an importance in recent years. Reducing the external costs such as environmental and air pollution, noise, accident and losses is an important factor as is increasing the operational efficiency and productivity of city logistics operations. Transportation plays a key role in urban areas and a functional logistics system depends on reliable, systematic and sustainable freight flow. The main purpose of urban logistics systems is to respond to the needs of the city. However, the costs and benefits of the logistics system needs to be taken into account. While the economic benefits increase as a result of improving of logistics activities, the living conditions of inhabitants can be adversely affected by logistics and transportation operations. Urban freight transportation causes a great number of problems such as congestion, air and environmental pollution, noise, emission and accidents, etc. The costs which affect the citizens directly are the sanitary costs due to the noxious emissions of the vehicles, the noise costs caused by the necessity of reducing the noise in the streets having a high daily average intensity, the congestion costs which mainly cause losses of time both to the users of the roadway and to the drivers of vehicles, and the costs of injury or death due to accidents amongst the urban circulation of goods vehicles.<sup>18</sup> On the other hand, the effect levels of these problems is not constant, they can change depending on many factors. If population, income level of habitants are increased in a city, volume of the logistics and transportation activities may increase simultaneously. Problems and the impacts caused by logistics and transportation activities may increase. International and domestic trading has been showing an upward trend. This situation suggests that the volume of logistics and transportation activities will gradually increase as it depends on the volume of trade. If this continues in the same way and something is not done as a precaution, problems will be intolerable in the near future.

New transportation alternatives should be sought in order to solve the urban logistics problems because reducing the freight flow is not possible. However, local authorities and governments have not created an effective and sustainable solution for solving urban logistics problems. The solutions that are created by policy makers should be imaginative and innovative. When the logistics potentials of urban areas are evaluated carefully, logistics opportunities which have been ignored previously can be seen more clearly. In order to reduce the economic and external costs of urban freight transportation, one of the best ways is to increase the level of use of the rail system rather than road transportation. In a city, if light rail systems which

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<sup>18</sup> Barcelo I. F., Campos-Cacheda J. M. (2012). Estimate of social and environmental costs for the urban distribution of goods. *Practical case for the city of Barcelona The Seventh International Conference on City Logistics, Procedia - Social and Behavioral Sciences* 39, p: 821.

can be used for passenger transportation are available, these light rail lines can be used for urban freight transportation without new railway infrastructure costs.

Light freight rail systems can provide systematic and regular freight flows in urban areas, they can also reduce the energy consumption, congestion, noise, emissions and other negative results that road transportation greatly contributes to. This system can also be integrated with the urban logistics system, and furthermore it may become part of an intermodal and combined transportation chain as an instrument which is used in the collection and distribution process. Collected cargo from different point on the light rail line can be transported by cargo trams to intermodal freight terminals. In addition, cargoes can be distributed from intermodal freight terminals to the delivery points by cargo trams.

There are extremely few studies related to the use of light rail systems for freight transportation in urban areas. Furthermore, there is no study on this topic in Turkey. The main purpose of this study is to indicate the potential of light rail systems. In this study, the environmental and economic impacts of light rail systems used in urban areas are analyzed. The results of this study may provide guidance for decision-makers and help fill an important gap. In this study, two main functions, namely distribution and collection, using light freight rail systems is evaluated in the light of concepts such as productivity and efficiency. In addition to passenger transportation, use of light rail systems for urban freight transportation can provide a more effective and productive logistics system configuration.

## 2. TRANSPORTATION SYSTEMS IN ISTANBUL CITY

Istanbul is one of the busiest cities in the world. Because of the fairly dense population living in Istanbul city, the volume of road traffic and density is extremely high. On the other hand, this city is dependent on other inland and overseas regions to meet its needs for products, semi-products and raw materials etc. For example, the amount of agricultural products produced in the urban area is not sufficient to meet the needs of the city, and its dependence is more apparent for food products, especially fresh fruits and vegetables. Large amounts of raw materials and semi-finished goods are daily brought to Istanbul, while large amounts of cargo is sent out.

There are many logistics nodes in Istanbul city. Although logistics activities and urban freight transportation are carried out and road freight transportation is mostly preferred between these logistics nodes freight flow is not systematic and orderly. It is common in urban distribution networks for suppliers to distribute only their own goods to retail outlets. This involves each supplier operating vehicles to carry each retailer's goods and vehicles must visit each retail outlet regularly from the supplier's warehouse<sup>19</sup>. When considering the environmental pollution, noise, accidents, congestion and energy cost the external costs which result from road transportation is very high and it is not tolerable. Air quality of Istanbul city is very poor and it is causing adverse living conditions for inhabitants. Traffic volume can

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<sup>19</sup>Thompson R. G., Hassall K. P. 2012. A collaborative urban distribution network, *Procedia - Social and Behavioral Sciences* 39, p: 215.

reach a peak in the center of this city. According to statistics issued by the general directorate of highways of the republic of Turkey, the total number of vehicles that pass across the two bridges in Istanbul city has reached 353,475, the number of heavy freight vehicles which operate along the same route was also recorded as 62,879<sup>20</sup>. Urban transportation is provided by two main roads which are the D-100 and E-80 highways. But road use is not balanced for either of these highways. The share of heavy freight vehicles in total traffic reaches 40% at night<sup>21</sup>. Whereas, it was observed that the share of automobiles is lowest at the same hours. More importantly, the traffic is concentrated in the city center, and traffic density falls very sharply from the city center to the outskirts of the city. Although the number of vehicles passing across the bridges of Istanbul is very high, it has been observed that the number of these vehicles greatly decreases at the next observation point. In recent years, the number of vehicles passing through the center of town was recorded as 353,475. In contrast, the number of vehicles observed in the next observation point was recorded as 219,761<sup>22</sup>. As a result, 133,714 vehicles are used within the city. The distance of routes located between observation points is 82.8 km. and the average number of vehicles that use these routes is calculated at 1615 per kilometer. More importantly, it was seen that, the total number of heavy freight vehicles was observed as 62,872 daily. Approximately 33,763 heavy freight vehicles reach the next observation points. However, 29,129 heavy freight vehicles were used in the center of the city. This figure is not appropriate for sustainable urban transportation. Even worse, creation of a systematic, sustainable and environmentally-friendly urban logistics system cannot be possible with such negative conditions.

On the other hand, changes related to trading and shopping habits have been observed, in the past, people did their shopping from small-scale shops located on both sides of the wide streets. Nowadays, people prefer large scale shopping malls to meet their different needs for things such as shopping, entertainment and socializing. Unlike the examples seen in European countries and the United States, shopping malls are located mostly in the center of Istanbul city. Shopping malls, which are located in the center of the city causes high levels of traffic congestion because of the use of freight vehicles which supply products and transport the waste together with road traffic caused by customers' private cars. Nowadays, 91 shopping malls are located in Istanbul city and the number of stores located in these shopping malls vary between 12 and 470. The average number of stores is 101 per shopping mall. Approximately 68% of these stores are supplied daily and the number of road freight vehicles used to supply the stores may reach 6256 daily.

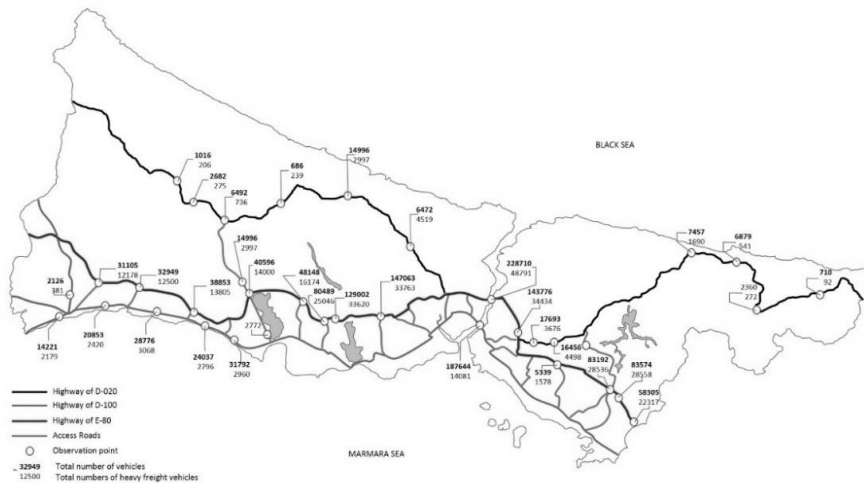
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<sup>20</sup>General Directorate of Highways of Turkey (GDH), 2012. Statistics of Transport and Traffic, Ankara, p: 34.

<sup>21</sup>General Directorate of Highways of Turkey (GDH), 2011. Specifications and Trends in Heavy Freight Transport on Highways, Ankara, p: 35.

<sup>22</sup>General Directorate of Highways of Turkey (GDH), 2012. Statistics of Transport and Traffic, Ankara, p: 34.

Figure 1 Urban Transportation Networks and Traffic Indicators in Istanbul City



As a result, shopping malls cause intensive logistics operations in a city. Because road freight transport is the most preferred transportation mode, costs of urban logistic activities is very high. External and economic costs of these operations are not tolerable. On the other hand, the number of shopping malls has been showing an upward trend in the center of the city. According to Reports of European Commission<sup>23</sup>, when the external costs of road transportation such as congestion, environmental and air pollution, accidents, fatalities and economic losses are taken in to consideration, it is seen that, the threshold related to creating a solution for the urban logistics problems has already been exceeded. If it continues in this way, neither logistics activities nor urban transportation can be carried out in the near future. Therefore, new and untried freight transportation alternatives should be considered by policy makers and researchers.

### 3. LIGHT RAIL SYSTEMS IN ISTANBUL CITY AND ITS POTENTIALS FOR CARGO TRAM OPERATIONS

Urban light rail systems may be an effective solution to the problems related to urban logistics systems. These systems can provide the opportunities to reduce the external costs of urban logistics operations carried out by road freight transportation and can especially help to reduce the emissions, economic costs, accidents etc.

<sup>23</sup> European Commission, An inventory of measures for internalizing external costs in transport, Directorate-General for Mobility and Transport, DM 28 - 0/110 – Archives, B-1049 Brussels, Belgium, November 2012 FINAL,p: 107-109.

Figure 2 Urban Rail Systems and Shopping Malls in Istanbul City



Nowadays, four different urban rail systems are operated in Istanbul city. These are conventional trains, metro rail system, light rail system and trams. Except for conventional rail transportation, they are used only for urban passenger transportation and using these transportation systems for freight transportation was not taken into consideration in Turkey until today. In Istanbul, urban rail systems intersect in the city center and they pass near all of these shopping malls. As a result, they can provide opportunities for freight transportation.

In both of sides of Istanbul city, urban rail systems are available and connections between urban and sub-urban areas of this city are provided by these systems. Usage rates of the urban rail systems are increasing in the city center compared to sub-urban areas. The starting point of the tram line is the Beşiktaş tram station and it is divided into two main routes in Topkapı tram station and the first tram line runs between Topkapı and Bağcılar stations. On the tram line, trams are run between Zeytinburnu and Hacıbaler tram stations.

The second urban transportation type is conventional trains. They can provide an opportunity to link east and west of Istanbul city. On the other hand, conventional rail lines have been uninterrupted by the Marmaray project that provides passage under the Istanbul Strait. In this rail system transportation between Gebze and Halkalı rail stations can be provided continuously. This rail line is mostly parallel to the shores of Istanbul, many shopping centers and shops are located near conventional railway lines. Nowadays, 42 railway stations are present on the conventional rail line. More importantly, improvement practices on the conventional railways lines have been carried out by policy makers recently. Particularly infrastructure rehabilitation works were carried out by the government at great speed.

The third urban transportation system is the subway. In Istanbul, the subway construction begun in 1992 and it was opened on 16 September 2000. In the past, it operated between Hacıosman and Şişhane subway stations and carried an average 285.000 passenger per day. They were not extensive and they serviced an extremely limited area. The subway operated between Hacıosman and Taksim subway stations

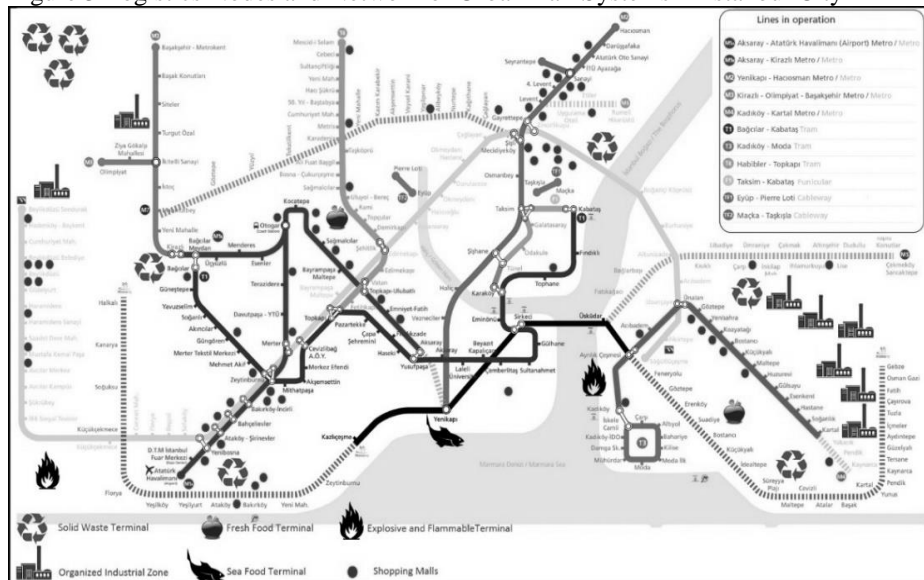
only, and the distance of this line was eight kilometers until recently. But this line was expanded to the Yenikapı subway station. In spite of the subway system giving transport service to a limited area, there are many shopping malls in this area and they are mostly located near this line.. Nowadays, 21 shopping malls and 312 stores are located around this subway line. In addition the number of visitors which come to these centers daily is very high and these shopping malls can g respond to intensive customers' demands. As a result of this, logistics material flows should be fast and faultless, on the other hand, excellent planned and organized logistics operations are needed for these shopping malls. The length of this subway line is 19.5 km at present.

Another urban rail transportation type is light rail systems. In Istanbul city, there are two main light rail lines: (M1) Aksaray - Istanbul Atatürk Airport light rail line and (M3) Basakşehir light rail line. These lines intersect at Kirazlı light rail station. Since 1989, the light rail lines carry to 320.000 passengers daily. The length of this line is 24, 77 kilometers and 22 rail stations are located on this line. 330 transportation operations are performed daily in both directions of this line. Light rail trains are run every three minutes. Another light railway line is Başakşehir light rail line. Its length is 16 kilometers and the number of station is eleven on this line. It was opened on 22 November 2013. Its capacity is 70.000 passengers/hour. 18 shopping malls are located near the two light rail lines.

Secondly, in order to have successful logistics and freight transportation operations, another requirement is the presence of logistics freight terminals and freight transfer points which should be located at the right places. These places should provide opportunities to reduce the logistics costs as well as improving the logistics freight flows. On the other hand, they must help to provide the integration between all the urban transportation systems and other logistics nodes. The new logistics terminals and freight transfer points located at appropriate locations is required in order to increase the urban logistics speed to an optimum level and to more effectively use these urban rail systems. Nowadays, shopping malls, trade centers and stores are clustered in certain regions. In the European side of Istanbul city, a large number of malls and shopping centers are mostly located between Maslak and Şişli regions. Seventeen malls are present in this area. Another region with many shopping malls is the Bayrampaşa - Topkapı region. Eight malls are located in this area, and the third important region is Yenibosna - Zeytinburnu region and it hosts fourteen shopping centers. Finally the fourth and last region is Beylikdüzü – Avcılar region, where approximately fifteen shopping centers are present.



Figure 3 Logistics Nodes and Network of Urban Rail Systems in Istanbul City



- *First Region* : Maslak–Şişli Region (17 shopping centers, subway line)
- *Second Region* : Bayrampaşa–Topkapı Region (8 shopping centers, tram and light rail line)
- *Third Region* : Yenibosna–Zeytinburnu Region (14 malls, tram, conv and light rail line)
- *Fourth Region* : Beylikdüzü – Avcılar Region (15 shopping centers, conventional line)

In the Anatolian side of Istanbul city, 27 shopping malls are located and most of them are near the urban rail systems. But connection between malls and urban rail system is not available because the rail systems are only used in passenger transportation. Two urban rail transportation lines, a conventional rail line and a subway are present in the Anatolian side of Istanbul city. At the same time a new subway line which will be located between Sancaktepe and Üsküdar subway stations is under construction. Completion and opening of this line is expected at the end of 2014. The conventional railway line works between Gebze and Haydarpaşa rail stations. The conventional trains carry freight as well as passengers in this line. The length of this line is 44.1 kilometers and the number of railway stations is 27.

On the other hand, the large number of organized industrial zones, solid waste collection centers, and fresh food and sea food terminals, small-medium scale industrial zones and explosive – flammable freight terminals are located around these lines. They can be defined as logistics nodes in Istanbul city.

They are not correctly positioned as appropriate to logistics needs of the city. Freight flows occur from these logistics nodes to shopping malls and stores, so these nodes are defined as suppliers for the urban logistics system. As they are not connected with the shopping malls and stores at the required level and road transportation is mostly preferred for transportation between logistics nodes and suppliers. All the logistics nodes that are located in Istanbul city are listed as below.



- *Organized Industrial Zones* : Beylikdüzü, Bahçeşehir, Tuzla and Umraniye regions
- *Fresh Food Terminals* : Bayrampasa and Kadıköy regions
- *Sea Food Terminals* : Yenikapi regions
- *Explosive Mat.Terminals* : Avcılar and Kadıköy regions
- *Solid Waste Terminals* : Bakırköy, Çatalca, Bağcılar, Besiktas, Umraniye and Maltepe regions

Currently, links provided by railway lines are not available between these logistics nodes in this city. Logistics activities are carried out by road freight transportation because of the lack of railway transportation alternatives. On the other hand, Istanbul city does not have specific logistics infrastructures such as freight transfer points and centers, urban intermodal freight terminals, cross-docking areas and consolidation centers.

The use of the urban passenger rail transportation systems for urban freight operations and the construction of logistics infrastructure in appropriate places can be one of the best ways for solving urban logistics problems. On the other hand, these logistics facilities should be connected with road and rail freight transportation modes, including maritime transportation. Four scenarios are proposed drawing on specific conditions and existing resources with urban rail systems in Istanbul city.

Use of the urban rail systems for distributing the products from suppliers to shopping malls and stores. The use of one or two wagons which will be added to the passenger wagons may be possible for deliveries of goods in the daytime. At the same time, urban rail lines are not used for passenger transportation at night, so it can be used more intensively. On the other hand, trip frequency and the number of trips are very high in all urban rail lines. As shown in Table 1, minimum number of trips is 165, minimum frequency of trips is two minutes. When all the urban rail system is taken into consideration, the number of trips was recorded as 1336 daily.

Table 1 Urban Rail Lines and Trip Specifications

Urban Rail Lines and Trip Specifications			
No	Name of the Line	Number of Trips	Frequency
M1	Aksaray - Atatürk Airport	165	3
M2	Yenikapi - Haciosman	225	9
M3	Başakşehir - Olimpiyatköy	216	6
M4	Kadıköy - Kartal	270	4
T1	Kabataş - Bağcılar	295	2
T4	Topkapi-Habibler	165	5

Freight trams can be used for distributing the goods from suppliers to shopping malls. They can also carry the solid waste from shopping centers to the solid waste terminals. If it can be applied, the reduction of economic and environmental costs of urban transportation may be possible because of an increase in the share of railway transportation.

#### 4. METHODOLOGY

Cost benefit analysis (CBA) is the most preferred methodology for evaluating a project that is defined in monetary terms. The main aim of CBA is defining the pros and cons of a project. In this evaluation process, benefits which will be obtained are compared to the costs of projects. If the benefits of a project are higher than the costs of this projects, this project may be preferred and implemented by decision makers. Otherwise, it may be ignored.

CBA methodology can help to evaluate the applicability of a project. Because public resources are limited, sometimes decision makers may have to choose between projects. CBA methodology can provide an effective solution for the decision-making processes. It can eliminate the uncertainty or it may reduce the uncertainty to a reasonable level. This methodology consists of a number of sub-processes and techniques. Initially, possible alternatives should be determined and appropriate and fair ways to examine their costs and benefits should be determined. Secondly all the costs and benefits should be defined within the framework of constant and quantitative values. For each project which is evaluated, costs and benefits should be compared with each other. After definition of the costs and benefits of the selected project, a systematic framework in the next process should be determined.

Cost benefit analysis consists of eight stages. In the first stage, a needs analysis, defining the limitations and describing the targets of the project is necessary. Secondly, to make a successful comparison among all the possible options, defining all options has great importance. As a result, all options should be defined by researchers. Third stage is data collection. In this process all datasets are collected and they are grouped and classified. In this study, the costs of the existing urban rail systems in Istanbul city were compared with their benefits and obtained results were analyzed. Costs of urban rail systems consist of economic costs such as energy consumption cost, purchasing costs of freight trains, maintenance-repair costs, logistics infrastructure installation costs and operation costs, including external costs such as costs of environmental pollution, costs of accidents and losses of life and economic assets.

Key factors in costs and benefits of transit include length of directional route miles, load factors, and the proportion of vehicles operating at road grade<sup>24</sup>. Energy costs are important in determining operation expenditures, and there is interaction among these factors as well<sup>25</sup>. In this paper, only economic costs and environmental costs were taken into consideration and other costs were excluded from the scope of this study.

## 5. ANALYSIS

One of the best ways to determine the optimum transport system is an evaluation of the economic costs of these transport alternatives. The costs of a

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<sup>24</sup>Lane B. W., Sherman C. P. 2013. Using the Kaldor–Hicks Tableau to assess sustainability in cost–benefit analysis in transport: An example framework for rail transit, *Research in Transportation Business & Management* 7,p: 93.

<sup>25</sup>Savage, I. 1997. Scale economies in United States rail transit systems. *Transportation Research Part A: Policy and Practice*, 31(6), 459–473.

transport system can be considered as unit costs per load-kilometer. Therefore, the specific cost calculation methodology focused to a fixed value is necessary to the definition of all the costs of transportation systems. Most appropriate cost evaluation methodology to obtain a successful result is the levelized cost methodology. In order to define total transportation costs more comprehensively, technical, economical and operational parameters for the transportation modes, such as road, rail and sea routes, should be set clearly as well as the effects of external costs, such as the costs of the accidents, emissions and noise<sup>26</sup>. In this study, all the costs of the selected two transportation alternatives of road transportation and urban rail freight transportation for logistics operation in urban area were defined in a framework of a fixed value as load-kilometer. This generalized cost evaluation methodology can be applied for both transport alternatives. According to this methodology, the costs of the transport system consists of investment costs ( $C_{in}$ ), energy consumption cost ( $C_{ec}$ ) and environmental costs ( $C_{em}$ ) and it excludes other costs such as noise, accidents, maintenance and repair costs, operation costs, etc.  $d$  represents the distance between two points. Total costs ( $C_t$ ) of transport system can be calculated as below;

$$C_t = uC_{in} + uC_{ec} + uC_{ex} \quad (1)$$

$$uC_{in} = \frac{\left( \left( \frac{C_{in} \cdot n_{vec}}{v_{el} \cdot a_{ot} \cdot d_{ot} \cdot m} \right) \cdot [u o_t + (n_s \cdot w t_s)] \right)}{v_k \cdot d} \quad (2)$$

$$uC_{ec} = \frac{(C_{ec} \cdot u_{ep} \cdot d_{po})}{v_k \cdot d} \quad (3)$$

$$uC_{em} = \frac{\left( \frac{(e_{co} \cdot d \cdot n_{vec})}{v_{tk}} \right) \cdot m_{ec}}{v_k \cdot d} \quad (4)$$

### 5.1. Cost of road transportation

In this study, cost analysis of road transportation is realized in terms of four routes to compare with costs of urban freight rail systems. Urban rail lines are available on selected routes as well as road transportation alternatives. Cost calculation depends on monetary terms and can be calculated in terms of unit ton-km.

Each route was analyzed due to their different characteristics. On the other hand, all the factors which are affect transportation costs were described in similar terms. In this model, road freight vehicles will stop at all the shopping malls located in a defined distribution zone. The first distribution zone (Z1) is the region between Haciosman and Yenikapı. 18 shopping malls are located in this region.

<sup>26</sup>Sahin B., Yilmaz H., Usta Y., Guneri A. F., Gulsun B. 2009. An approach for analyzing transportation costs and a case study European Journal of Operational Research 193, p: 1–11

When a road freight vehicle stops at all the malls, the length of the route is 107.5 km per trip. Capacity of each road freight vehicle is 3.5 ton. A distribution operation can be completed in 168 minutes from starting point to end point. Average waiting time is ten minutes per stop. Extraordinary circumstances such as accidents and traffic congestion, were not included in the evaluation. The second distribution zone (Z2) is the region between Aksaray and Bağcılar. The number of malls is 30 in this region and the total operation time is 164 minutes per distribution operation and the length of the route is 100.2 km.

The third distribution zone (Z3) is the Anatolian region starting at Pendik and ending at Kadıköy. Total distance between the two points is 122 km and a distribution operation is completed in 178 minutes. 21 malls are located in this region. The fourth distribution zone (Z4) is the region located between Bağcılar and Bahçeşehir. 5 malls are located in this region and the length of this route is 49.7 km. The distribution operation is completed in 72 minutes. All of variables and symbols can be seen in Table 2 for road transportation related to each lines. All of the variables are obtained from official source. In Istanbul metropolitan area, using road vehicles types are limited. In general, a road freight vehicle can be entered to center of city if its capacity is under 3.5 tones.

Table 2 Urban Distribution Specifications by Road Freight Transportation

	Unit	Symbol	Z1	Z2	Z3	Z4
Investment Cost of Vehicle		€	23.500	23.500	23.500	23.500
	$C_{in}$					
Number of Vehicles	$n_{vec}$	Number	15	1	1	1
Unit Vehicle Capacity	$v_k$	tons	3,5	3,5	3,5	3,5
Economic Life of Vehicle	$v_{el}$	Year	25	25	25	25
Annual Operation Time	$a_{ot}$	Day	365	365	365	365
Daily Operation Time	$d_{ot}$	Hour	24	24	24	24
Unit time	$m$	Min	60	60	60	60
Time per Operation	$u_{ot}$	Min	168	164	178	72
Number of Stations	$n_s$	Number	18	30	21	5
Waiting time per Station	$wt_s$	Min	10	10	10	10
Unit Energy Price	$u_{ep}$	€	1,5	1,5	1,5	1,5
Unit Energy Consumption	$C_{ec}$	Lt/100 km	30%	30%	30%	30%
Distance per operation	$d_{po}$	Km	107,5	100,2	122	49,7
Emission coefficient	$m_{ec}$	gr	175	175	175	175
Emission Marginal Cost	$m_{ec}$	€	75.66	75.66	75.66	75.66
coefficient Gram to ton	$v_{tk}$	ton	1.000.000	1.000.000	1.000.000	1.000.000

For each route, when the determined values are considered, total costs of road transportation can be calculated. Total and unit costs can be seen below; while unit cost of road freight transportation is calculated as 0.411 € / tonxkm as below in Table 3.

Table 3 Road freight transportation costs

	Z1	Z2	Z3	Z4	Total
Cost of Investment (€)	0,00165	0,00237	0,00163	0,00125	0,00690
Cost of Energy Consumption (€)	0,12857	0,00378	0,12857	0,12857	0,38950
Cost of Emission (€)	0,00378	0,00378	0,00378	0,00378	0,01513
Total Costs (€)	0,13401	0,00993	0,13398	0,13361	0,41153

## 5. 2. Cost of urban rail system

Total costs of urban rail systems show similar characteristics to road freight transportation. Whereas, these transport systems cannot provide optimum solutions related to door to door transport operations. Cargoes may be distributed to malls located near the urban rail lines. If the shopping center is located at a point far from the railway lines, short-distance road transportation can be used to solve distribution problems. On the other hand urban freight rail vehicles can carry 15 tons of cargo per operation. These vehicles can run on a single line and cargoes can be distributed to malls in one direction. On the other hand, solid waste can be collected from shopping centers while returning to the starting point. When the cost evaluation methodology is applied to road freight transportation in urban areas, cost analysis should be done for each urban freight rail alternative because six urban rail lines are available in this city. On the other hand, each rail system has different characteristics and unique conditions. All of the urban freight rail lines and their specifications are shown in Table 4.

Table 4 Urban Rail Lines and Trip Specifications

Description of Vehicles	Sym	Unit	M1	M2	M3	M4	T1	T4
Invest. Cost of Vehicle	$C_{in}$	€	1,800,185	1,800,185	1,800,185	1,800,185	1,800,185	1,800,185
Number of Vehicle	$n_{vec}$	Num.	1	1	1	1	1	1
Unit Vehicle Capacity	$v_k$	tons	15	15	15	15	15	15
Economic Life of Vehicle	$v_{el}$	Year	25	25	25	25	25	25
Annual Operation Time	$a_{ot}$	Day	365	365	365	365	365	365
Daily Operation Time	$d_{ot}$	Hour	24	24	24	24	24	24
Unit time	$m$	Min	60	60	60	60	60	60
Time per Operation	$u_{ot}$	Min	52	27	20	32	65	42
Number of Station	$n_s$	Num.	22	16	11	16	31	22
Waiting time per Station	$wt_s$	Min	5	5	5	5	5	5
Unit Energy Price	$u_{ep}$	€	1,5	1,5	1,5	1,5	1,5	1,5
Unit Energy Consumption	$C_{ec}$	liter	0,04	0,04	0,04	0,04	0,17	0,17
Distance per operation	$d_{po}$	Km	49,54	39	31,8	43,32	37	30,6
Emission coefficient	$m_{ec}$	gr	2,7	2,7	2,7	2,7	2,7	2,7
Emission Marginal Cost	$m_{ec}$	€	75.66	75.66	75.66	75.66	75.66	75.66
Coefficient Gram to ton	$v_{tk}$	Ton	1.000.000	1.000.000	1.000.000	1.000.000	1.000.000	1.000.000

When all the zones are considered, M2 subway line is located in zone Z1, M1, T1 and T4 are located in Z2, zone of M4 are run in zone of Z3 and M3 subway line can provide a service in Z4. From table 5, transportation costs for each zone can be calculated as below;

Table 5 Urban Rail freight transportation costs

	Z1	Z2	Z3	Z4	Total
Cost of Investment (€)	0,02506	0,12954	0,02361	0,02154	0,19975
Cost of Energy Consumption (€)	0,00400	0,03800	0,00400	0,00400	0,05000
Cost of Emission (€)	0,00001	0,00004	0,00001	0,00001	0,00008
Total Costs (€)	0,02907	0,16758	0,02764	0,02557	0,24986

As seen in table 4, unit energy consumption is converted from mega joule (MJ) to one liter of diesel. Average energy consumption of trams is 5.5 MJ per kilometer

and energy use of subways is 1.3 MJ per kilometer.<sup>27</sup> When one liter diesel is equal to 32.2 MJ energy, unit energy consumption of trams is equal to 0.04 liter diesel per kilometer, and energy consumption is equal to 0.17 liters in trams. At the same time, unit emission values of trams and subways is equal to 2.7 gr CO<sub>2</sub>/kilometer. CO<sub>2</sub> emissions have not been part of Euro emission standards to date<sup>28</sup>. However this is about to change with the European Commission planning to impose limits on the amount of CO<sub>2</sub> emitted by new vans, restricting it to 175 g/km CO<sub>2</sub> by 2012 and 160 g/km CO<sub>2</sub> by 2015 (European Commission, 2008). The calculated emission value caused by heavy road vehicles is very high. According to an important scientific study realized by the Research Center of Marine and Climate at the University of Hamburg, the marginal cost of emission is calculated as 104 dollars per ton<sup>29</sup>. Unit energy cost is 1.5 € currently in Turkey. Unit transportation cost including the investment, energy consumption and external cost can be calculated as 0.249 €/tonxkm. When this figure is compared to road transportation costs, it is seen to be almost half the road transportation cost.

#### 4. CONCLUSION

If road freight transportation cost is compared to urban rail transportation costs, the urban rail transportation cost is almost half the road transportation cost in urban areas. Furthermore urban rail systems can provide better environmental conditions and more reduced external costs as well as economic advantages compared to road transportation. Urban rail systems can affect the environment at almost half the rate of road transport. Consequently, the usage rates of urban rail freight systems can be increased, and obtained benefits may be increased in urban logistics operations. Finally, the benefits provided by more effective logistics activities may affect all the parties of logistics, such as companies, governments, local authorities, users and inhabitants.

#### 5. REFERENCES AND SOURCES OF INFORMATION

1. Barceloa, I. F. & Campos-Cachedaa, J. M. (2012). Estimate of social and environmental costs for the urban distribution of goods. *Practical case for the city of Barcelona The Seventh International Conference on City Logistics, Procedia - Social and Behavioral Sciences* 39, p. 821.
2. Browne, M., Allen, J., Nemoto, T., Visser, J. (2010). Light goods vehicles in urban areas, *Procedia Social and Behavioral Sciences* 2, p. 5915.
3. European Commission, An inventory of measures for internalizing external costs

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<sup>27</sup>Kalenoja, H., 1996. Energy consumption and environmental effects of passenger transport modes - a life cycle study on passenger transport modes, Trafficdage, Aalborg, Denmark, 2-12.

<sup>28</sup>Browne M., Allen J., Nemoto T., Visser J. 2010. Light goods vehicles in urban areas, *Procedia Social and Behavioral Sciences* 2, p: 5915.

<sup>29</sup>Tol, R.S.J. 2003. The marginal costs of carbon dioxide emissions: an assessment of The uncertainties, *Centre for Marine and Climate Research, Hamburg University, Hamburg, Germany*, Working Paper FNU-19: 1.

- in transport, Directorate-General for Mobility and Transport, DM 28 - 0/110 – Archives, B-1049 Brussels, Belgium, November 2012 FINAL, pp. 107-109.
4. General Directorate of Highways of Turkey (GDH). (2011). Specifications and Trends in Heavy Freight Transport on Highways, Ankara, p. 35.
  5. General Directorate of Highways of Turkey (GDH), 2012. Statistics of Transport and Traffic, Ankara, p. 34.
  6. Kalenoja, H. (1996). Energy consumption and environmental effects of passenger transport modes - a life cycle study on passenger transport modes, Trafficdage, Aalborg, Denmark, pp. 2-12.
  7. Lane, B. W. & Sherman, C. P. (2013). Using the Kaldor–Hicks Tableau to assess sustainability in cost–benefit analysis in transport: An example framework for rail transit, *Research in Transportation Business & Management* 7, p. 93.
  8. Sahin, B., Yilmaz, H., Usta, Y., Guneri, A. F., Gulsun, B. (2009). An approach for analyzing transportation costs and a case study European Journal of Operational Research 193, pp. 1–11.
  9. Savage, I. (1997). Scale economies in United States rail transit systems. *Transportation Research Part A: Policy and Practice*, 31(6), pp. 459–473.
  10. Thompson, R. G. and Hassall, K. P. (2012). A collaborative urban distribution network, *Procedia - Social and Behavioral Sciences* 39, p. 215.
  11. Tol, R.S.J. (2003). The marginal costs of carbon dioxide emissions: an assessment of The uncertainties, *Centre for Marine and Climate Research, Hamburg University, Hamburg, Germany*, Working Paper FNU-19: 1.



## **APPLYING NEW DISTRIBUTION CHANNELS IN HISTORICAL CITY CORES IN THE ADRIATIC REGION**

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### ***Abstract***

Ancient cities in the Adriatic region are facing similar challenges from the transportation (personal mobility) and logistics (city supply) point of view. City cores are usually small, streets are narrow, and the possibilities of the infrastructure do not match the needs of the 21<sup>st</sup> century. While urbanization and its effects are undoubtedly everywhere, historical city cores are often unable to meet modern logistics and distribution needs. As a result of urbanization and altered consumer needs, new types of shopping facilities have been developed, usually in decentralized locations, while the largest town and city centers have retained their commercial dominance. These changes have had significant negative competitive effects on all types of smaller traditional centres, especially middle-order centres (small towns, district centres and small market towns), where a 'spiral of decline' has been widely evident. Many communities face the prospect of losing their commercial and social focuses. In this paper, we present a case study of a typical small city from the Adriatic coast, which – due to its unique characteristics and location – facing several logistics, social and economic challenges. After introducing the main challenges, our preliminary findings and our research methodology, we propose a logistics solution- namely the FMCG pickup point network - which might enable the city, and other similar cities in the region, to recover itself and provide a smarter city for tourists and investors for many more years to come.

**Key words:** adriatic, distribution channels, historical center, measurement

## 1. INTRODUCTION

According to the OECD (Organization for Economic Co-operation and Development), a significant increase has been observed in the number of people living in the cities all over the world. In 1950, the proportion of people living in cities in comparison with the whole population of the world was 50 %, and by the year 2000 it increased to 77 %. Researches predict that in 2020 the proportion of people living in the cities all over the world will be as high as 85 % (OECD, 2003) (Crainic, *et al.*, 2008).

The increase of urbanization undoubtedly has had a significant impact on many factors effecting social-economic development of cities. Increasing number of inhabitants results in the increase in turnover of goods as well as in the emergence of new production and trade companies. Consequently, the problems resulting from excessive number of passenger cars and trucks on municipal roads have arisen. This is connected with longer commuting time in the city, worse quality of roads, decreasing sense of safety or with problems with parking (Paglione, 2006). As the result, such situations have impacts on decreasing the quality of life of the inhabitants. According to Taniguchi, effective and environment friendly city logistics requires a vision that could be accomplished by setting aims within three fields (Taniguchi *et al.* 2003):

- Mobility,
- Sustainability,
- Liveability.

The main aim of 'mobility' is to obtain a balance between sufficient traffic capacity and decrease in congestion. 'Sustainability' refers to an essential issue, that is, environmental protection and energy saving. (Witkowski and Kiba-Jainak, 2012). 'Liveability' refers to the issues connected with the quality of life, such as safety, health, silence, attractiveness of the place of living, etc. (Tseng, *et al.*, 2005). In Taniguchi's opinion 'city logistics provides an opportunity for innovative solutions to be developed for improving the quality of life in urban areas' (Taniguchi, *et al.*, 2003)

## 2. CHARACTERIZING CITIES BASED ON LOGISTICS INFRASTRUCTURES AND NEEDS

The Adriatic seashore is a one of a kind area in Europe. Old fishing towns - which used to foster the surrounding areas - turned into popular tourist destinations, but at the same time, lost their industrial and economic potentials. Residents are usually working in more industrialized bigger cities nearby, therefore their dependency on cars and personal mobility is inevitable. While the structures and specializations of these cities are so diverse, they can be characterized based on their

transportation and logistics infrastructures and needs. Based on this hypothesis, we have formed 4 typical groups:

1. Metropolis (Trieste, Split)
2. Port and Industry (Rijeka, Koper)
3. Tourist center (Hvar, Porec, Piran, Portoroz)
4. Promising small town (Izola, Umag, Novigrad)

Our hypothesis assumes that the competitiveness and attractiveness of these cities depends on:

- the share of tourism versus other workplaces
- number and age of inhabitants / tourists / seasonal workers
- length of tourist season
- available transport and logistics infrastructure
- available services and shopping opportunities
- quality of life
- sights in town and in the surroundings
- prices of services and goods
- reputation

In our case study, we investigated and observed the Slovenian city of Izola, where – due to its location, historical city core and once industrial quarters – there are several boundaries before developing the factors mentioned above.

### 3. CASE STUDY - IZOLA

Izola is an old fishing town and a municipality in southwestern Slovenia on the Adriatic coast of the Istrian peninsula. Its name originates from the Italian *Isola*, which means 'island'. The ancient city – which is now the old city core – used to lie on island that was connected to the mainland by ballast over the centuries. While other parts of the town developed and rebuilt themselves, the old city core remained unchanged –and became less and less attractive to citizens and investors.

Before World War II, Izola was the economic center of its region. Several factories were built, and Izola kept its attractiveness even when the nearby Koper and Piran were struggling from the effects of the economic crisis. The postwar economic and demographic rise of Izola was based on the toy industry, food industry and shipbuilding, as well as on the development of tourism. Urban growth was correlated with territorial expansion, and the adjacent former villages of Livada and Jagodje were attached to Izola. (see on Figure 1.)

However, in the early 1990s, things started to change within the city. While the neighboring cities were able to revitalize themselves, Izola had suddenly faced several logistics-based problems. The significantly increased car usage and lack of parking spaces, the decay of the industry and – due to the lack of shopping opportunities – unfulfilled consumer needs were expectations the old city core was

not able to satisfy. The lack of services and infrastructure boundaries soon made the population to move their residence outside the city core, and caused an indirect decentralization. Migration from the city core lowered real-estate prices, making the area attractive for immigrants and low-class workers. Physical and functional obsolescence appeared, and the area has reached the declining phase of its lifetime.

While the most popular tourist attractions – namely the dining and leisure area and the beach – are located within the old city core, reconstruction and revitalization of buildings and infrastructure are very difficult for the municipality. Besides of the fact that most of the estates are privately owned, several of them are part of the city's cultural heritage. The absence of shops and markets in walking distance forces tourists and citizens to use their cars all the time, while the limited amount of parking spaces and narrow streets are unable to handle the increased number of cars within the old city.

Figure 1 The city of Izola (including Livade and Jagodje)



#### 4. PROBLEM STATEMENT

In the past, there has been several efforts and measurements led by the municipality in order to decrease the car load of Izola's city core. Ideas about car-free or eco-friendly zones, bike-rental and public transport development were considered – and were mostly rejected by tourists and inhabitants, or by the municipality itself. Meanwhile, the obsolescence of estates and roads reached a critical level.

Based on our observations and deep interviews with both locals and tourists, the people of Izola have two reasons not to leave their car at home. (1) is the lack of workspaces within the city, that forces people to commute on a daily basis and (2) is the lack of shopping opportunities and the proximity of the nearby shopping centers of Koper. Although the needs and expectations of citizens and tourist regarding Izola are different, there is one key factor in common: time is a valuable asset for both of them. And spending long minutes in a queue at the cashier or in traffic jams around the shopping center is not only a waste of time, but also a waste of money.

While there are four major supermarket chains represented in Izola – Mercator, Eurospin, Spar and Aldi -, all of them are too far from the center to access them on foot (Figure 2).

When considering alternatives to achieve reduced car usage – despite of the above-mentioned obstacles – approaching the problem from a different perspective can result in different solutions. If it takes time, money, efforts and social responsibility to go shopping by car, then why not bring the shops closer to the end consumer; or as the proverb says: "If the mountain won't come to Muhammad then Muhammad must go to the mountain."

Figure 2: The locations of shopping malls in relation with the city center



Over the past decade, e-commerce has experienced steady growth all around the world. A striking aspect is that it is now widespread among different segments of the population, including suburban and rural households. This growth has generated significant demand for dedicated delivery services to end consumers. E-retail, like many other information technology-based activities (telecommuting, telemedicine

etc.) offers a potential substitution of travel by telecommunications. Traditional shopping activities typically consist of a visit to a store in which product information is sought, and a decision on purchase is made. Pending that decision, the product is obtained and most often self-delivered by the consumer. Certain types of products are store-delivered to the consumer premises. In the face of E-retail, consumers can acquire information, make a purchase transaction and choose a delivery arrangement from a remote location. (Morganti, Dabanc and Fortin, 2014) These options may result in a reduction of transport activity, as a delivery by the supplier is potentially more efficient than the traditional process. (Rotem-Mindali and Salomon, 2007) Regarding transport models from a city logistics point of view, three main delivery strategies are commonly seen in practice:

(1) Home deliveries from a supermarket, where orders are prepared by a picker (store-picking), mainly on the outskirts of the urban area without major changes in the supply strategy. The purchased products are either directly delivered at home or picked up by the consumer, mainly by car, avoiding queues and waiting times at the checkout of the store (car picking services are also known as “shopping drive”). However, for proximity supermarkets or commercial centers with good public transport accessibility, car is not the only transport mode for end consumers. In all cases, these trips can be assimilated to personal trips for shopping purposes.

(2) Home deliveries from a specific warehouse, where orders can be prepared (warehouse-picking) and where important changes are noted in the supply chain, because the warehouse is not located in a peripheral area. Then, the ordered products are delivered to the place of consumption using light goods vehicles, through an optimized route. These trips are made by small city freighters and can be assimilated to traditional e-commerce home deliveries with more restrictive constraints.

(3) Out Home Deliveries (Pick up points) - through proximity reception points, where the supply changes consist of including new local depots. In this case, the ordered products are directly transported to a depot (pick-up point), located near the place of consumption where they are picked up by the final consumer (Cairns, 1996)

After the deep examination of all three strategies Durand and Gonzalez-Feliu (Durand and Gonzalez Feliu, 2011) had shown that the combination of Scenario (3) (Pick up points) and Scenario (1) (Store picking) seems to be, *a priori*, the most favorable: more than 30% gain in driven km when the utilization rate is 50%. This reflects a sharp decline in motorized shopping trips over 30% drop, with the assumption that the pick up points are located near the heart of residential neighborhoods and the density of these points is sufficient to lead to changes in user behavior, including the use of their car. According to Taniguchi and Kakimoto (Taniguchi and Kakimoto, 2003), the application of models to test road network indicates that introducing e-commerce (B2C) may lead to more traffic in urban areas and make negative impacts on the environment unless e-commerce is widely used by consumers to some extent. However, some measures including co-operative freight transport systems of home delivery companies and designating time windows by home delivery companies and pickup points are effective to reduce the total costs as well as total running times and NOx emissions.

## 5. METHODOLOGY AND PRELIMINARY RESULTS

In order to examine the *raison d'être* of establishing a pick up point network in Izola, we have constructed a measurement strategy and methodology to record and analyze key influential factors. While there have been traffic flow and other transportation measurements in Izola before, most of them focused mainly on suggestions for future infrastructure development instead of solving the daily, everyday problems of the city and its inhabitants. However, they had provided relevant starting points for our investigations, as they pointed out key spots and outbreaks within the city.

Our measurements were executed using our self-developed, Android based application, the Elli3 Pro©. Through customizable screens and voice recording possibilities, the Elli3 Pro is able to measure and record various activities – from order-picking processes till traffic counting. Later, the acquired data can be easily exported and promptly evaluated on any computer.

During the preliminary tests of the methodology, we have made several measurements regarding parking spaces, the number of pedestrians, cars and bikes entering the city and the beach, and the proportion of local (Koper region) cars versus cars from other parts of Slovenia and from abroad. We have also observed customers entering the only small shop within the city center, as well as the peak and off-peak hours at local shopping malls.

Based on our observations, local shopping malls have three major peak periods, early in the mornings (7-9 am), early afternoons (2-4 pm) and early evenings (6-7 pm). Besides these intervals, we assume that there might be free capacities for shop assistants to collect, consolidate and send the electronically ordered goods from local malls to the pick up points. However, in order to prove our assumptions, further scenarios, investigations and measurements are necessary.

In order to establish an ideal density and location of pick up points, measurements inside the old city cores are also inevitable. Our measurements pointed out, that there is a huge density of pedestrians around the Marina bay and the beach throughout the whole day – with an average of 500 pedestrians in the afternoons and more than a thousand in the evening. These preliminary results had shown, that with well-located pick up points and with extended opening hours, the vast majority of tourists and locals could be attracted to use this option instead of using their car within the city core.

## 6. CONCLUSIONS

In our paper we presented the pick-up point distribution channel as a new innovative methodology for fulfilling logistics needs in Adriatic towns – as an example we made some preliminary research in the city of Izola at the Slovenian coast. Applying the methodology of Elli3 Pro measurements we were able to prove that all critical factors to establish an effective pick-up point network are present, however – since all of our measurements were conducted during the season - further off-season measurements and the financial analysis of sustainability are necessary.

According to the idea and the results we can conclude that pick-up point distribution network, as new type of urban logistics tool might enable the city – and other similar cities in the region - to recover itself and provide a smarter city for tourists and investors for many more years to come.

## 7. REFERENCES

1. Durand, B. & Gonzalez-Feliu, J. (2012). *Urban Logistics and E-Grocery: Have Proximity Delivery Services a Positive Impact on Shopping Trips?*; in Seventh International Conference on City Logistics, Spain
2. Cairns, S. (1996). *Delivering alternatives: Successes and failures of home delivery services for food shopping*; in Transport Policy, Volume 3, Issue 4, pp. 155-176.
3. Crainic TG, Gendreau M, Potvin J-Y. (2008). *Intelligent freight transportation systems: Assessment and the contribution of operations research*. CIRRELT; pp. 14-15.
4. Morganti, E., Dablanc, L., Fortin, F. (2014). *Final deliveries for online shopping: The deployment of pickup point networks in urban and suburban areas*; in Research in Transportation Business & Management, Volume 11, pp. 23-31.
5. Rotem-Mindali, O. & Salomon, I. (2007). *The impacts of E-retail on the choice of shopping trips and delivery: Some preliminary findings*; in Transportation Research Part A: Policy and Practice, Volume 41, Issue 2, pp. 176-189.
6. Taniguchi E, Thompson RG, Yamada T. (2003). *Visions for city logistics in logistics systems for sustainable cities*. In: Taniguchi E, Thompson RG, editors. Proceedings of the 3th International Conference on City Logistics, Madeira Portugal, pp. 1-2
7. Taniguchi E. & Kakimoto, T. (2003). *Effects of e-commerce on urban distribution and the environment*, Journal of Eastern Asia Society for Transportation Studies, p. 5.
8. Tseng Y.Y., Yue, W.L., Taylor, M.A.P. (2005). *The role of transportation in logistics chain*. Proceedings of the Eastern Asia Society for Transportation Studies, pp. 1657-1672.
9. Witkowski, J. & Kiba-Janiak, M. (2011). *Correlation between city logistics and quality of life as an assumption for referential model*; The Seventh International Conference on City Logistics, Spain



## **EDUCATION OF LOGISTICS AT MANAGEMENT AND PRODUCTION ENGINEERING STUDIES AT CRACOW UNIVERSITY OF ECONOMICS**

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### ***Abstract***

The development of the logistics sector in Poland has contributed the rapid development of logistics education in the country in recent years. The growing demand for employees with logistics meant that more and more universities launched faculties and departments related to this field. Universities logistics personnel are trained in bachelors and master's degree majoring in logistics and logistics of various specializations offered in the economic and technical fields of study. As part of the currently valid classification of occupations Polish labour market needs also in the group of occupations engineers for the industry and recognized profession logistics. One of the fields of studies educating engineers just such a major in Management and Production Engineering. This direction should be the area of education in the social science and engineering, with learning outcomes leading to a vocational engineering competence.

The aim of the work is the presentation of the learning outcomes of education in the profession of logistics developed for this direction led to the Department of Commodity Science at Cracow University of Economics.

**Key words:** logistics education, professions, learning outcomes

### **1. INTRODUCTION**

At present, logistics is considered to be the basis of functioning of every modern business. It became, not only a chance, but a requirement of modern times, in which the processes connected to the goods exchange are more and more complex and the necessity to adapt to the needs and the purchasers' requirements goes with compulsory lowering of activity costs in order to face up to the competition on the markets.

In Poland, the logistics sector is developing very dynamically. During the last 25 years of economic changes, Poland, beginning from the outsider position in Europe, found itself among the logistics leaders. The domestic logistics and transport companies' income scale proves that the logistics sector significantly develops. They reach 100 billion zlotys very year, which is 5 percent of the Polish

GDP. The sector employs about half a million people. According to the Central Statistical Office, there are over 140 thousands of companies on the Polish market. They can be included to the TSL sector. Most of them provide only transport services and these are enterprises, which employ up to nine employers. On the other hand, there are some enormous logistics operators offering extended services, which significantly outreach beyond transport and storage. They can extensively satisfy the needs of even the whole chains of supplies (Olechowski & Jabłonowski, 2013).

The logistics sector in Poland is developing. It proves the fact that many Polish manufacturers and traders have created their own logistic systems and advanced chains of goods` supplies have been organized. Poland also owns the base of modern warehouses. What is more, it is in the lead of the best localizations of such investments in the world. (Stefaniak, 2014)

Simultaneously, as the analyses from the range of the labour market needs show – in the coming years the global problem will be the phenomenon of the specialists shortage, including the ones from the logistics range. According to the report prepared by the World Economic Forum with the cooperation of *The Boston Consulting Group* (BCG), to 2020 and to 2030 year, in 25 countries, 13 sectors and 9 categories there will be a problem of employers shortage. It is estimated that the biggest deficiency is predicted, among others, among engineers and most work offers will come from logistics-transport sector. It is assessed that in a few years' time Poland may lack 46 000 - 70 000, and even 100 000 engineers, and in the countries of the European Union 2 million. The majority of them will be from logistics sector. (Brzeziński, 2012).

Additionally, the first ten in the ranking for the best profession in 2013 year, published by the Forbes, shows that a logistician was on the sixth place of the most wanted jobs. (Młynarczyk, 2014).

The growing need for employees with logistics education caused that more and more higher schools launched fields and specialisations connected to this area. The schools educate logistics staff on the I and II degrees studies in the field of Logistics and different logistics specializations offered as part of economics and technical field of studies.

What is more, the logistics knowledge is also taught at postgraduate studies and participants of logistics trainings (including e-learning ones). The occupation of a logistician is becoming more meaningful. It proves the fact that two higher schools with the logistics profile have been created: Poznan School of Logistics and the International University of Logistics and Transport in Wrocław.

Educating logisticians is directed on getting jobs connected to abilities of doing different logistic tasks and to do the scope of duties, which have been placed among jobs and specializations for the needs of the labour market.

At present in Poland, the Ordinance of the Minister of Labour and Social Policy from 27 April 2010 year, is in force. It concerns classification of occupations and specializations for the labour market needs and the range its use, in which the classification from the International Standard of Classification of Occupations ISCO-08 has been accepted. The classification is a five level, hierarchically arranged set of occupations and specializations which appear at the labour market. On its first level, there are occupations belonging to the group of the representatives of national

public authority, higher officials and managers. However, on the second level, there is a group called specialists. Among the occupations and specializations included in the subgroup of occupations of trade and production engineers, the job of a logistician has been taken into consideration.

This occupation, regarding its classification to the group, requires possessing vocational knowledge, ability and experience in the scope of technical, nature, social, humanistic science and the related. The main tasks standing before the ones doing this job is introducing scientific concepts and theories, enlargement of existing knowledge by the research, creativity and systematic education in this scope. A logistics engineer must possess adequate qualifications (knowledge and skills) got in the result of the education process.

At the fields of study educating such engineers is Management and Production Engineering. This field belongs to the area of education in the scope of social and technical sciences, with the learning outcomes leading to get engineering competences.

The aim of this work is the presentation of learning outcomes concerning education in occupation of a logistician elaborated for the above field at the Faculty of Commodity Science at Cracow University of Economics.

## **2. THE LEARNING OUTCOMES AT MANAGEMENT AND PRODUCTION ENGINEERING STUDIES AT CRACOW UNIVERSITY OF ECONOMICS**

When the new amended act started to be in force, in 2011 year – higher education law and executive acts defining the rules of introducing, at Polish Universities, National Qualifications Framework (KRW in Polish), conditions favouring better adaptation of didactic offer to the needs of the labour market have been created. The benefits connected to introducing KRW result from acceptance of the concept of describing qualifications by assuming effects of educating, including the set of general skills (useful independently from the career path) and connected with the field of study. A change of approach to the educating process is connected to it. The most important aim of this process is a guarantee that a student achieves assumed effects of education defined in the Recommendation of the European Parliament and the Council from 18 June 2009 year as statements defining what a student should know, understand, what abilities, skills and social competences they should possess after finishing the process of education (Fig.1) (Lisińska-Kuśnierz, 2012).

Figure 1 Descriptions of learning outcomes



Source: own work

The educating effects presented in the above Figure define:

- Knowledge – as the effect of absorbing information by studying. As a set of facts, rules, theories and practice connected to the field of work or science. In the context of European frames of qualifications described as theoretical or factual knowledge.
- Skills – as the ability to use the knowledge and the know-how in order to do the tasks and solve the problems. In the context of European frames of qualifications defined as cognitive (including logical, intuitive and creative thinking) and practical (including the ability and the use of methods, materials, tools and instruments).
- Competences – as the proved ability to use the knowledge, skills and personal, social or methodological abilities, showed at work or science and the professional and personal career. In European frames of qualifications, competences defined in the categories of responsibility and autonomy.

In connection to the new legal context of teaching in higher schools and the demands resulting from the standard of occupations classification, as mentioned above, a logistician should be a graduate of the field of study in the area of social technical and nature studies with the educating effects leading to engineering competences.

A very important tip in defining educating effects for a given field of study, should also be the employers' expectations, who look for the specialists.

In case of the logistics specialists, the employers' expectations, the identification on the basis of the analysis of the recruitment advertisements focus around the following skills of the candidates:

- the ability of analytical and creative thinking,
- the ability of team work and negotiation, communication skills,
- the ability to use the calculation techniques,
- the ability of planning, the use of time and making decisions,
- the ability to speak foreign languages and the knowledge of cultural diversity,
- the knowledge of economic law in Poland and in the European Union,
- the ability to use computer systems used in logistics,
- the ability of constant improvement,

- the ability of diagnosis of threats and early warning.

Taking into consideration the requirements for the occupation of a logistician, resulting from the jobs qualifications and the expectations of the employers who look for logistics specialists at the Management and Production Engineering Studies, at the Faculty of Commodity Science at Cracow University of Economics, the following learning outcomes:

In the scope of knowledge:

- the knowledge in the character of social science, their place in the system of science and relations in relation to other sciences and the knowledge necessary to understand social, economic, legal and other out of tech conditioning of engineering activity,
- the general knowledge from the area of technical science embracing the key issues for the field,
- the general knowledge from the area of mathematics, physic, chemistry and other areas proper to the field,
- the knowledge connected to the chosen issues from the area of managing and engineering production, including: the processes and manufacturing techniques, production and services management, expenses management, designing, processes and production systems supervision, supervision of objects and managing systems, quality and safety management and having a business activity,
- the knowledge about different kinds of social structures and institutions and the relations, which appear between them in the domestic and international scale,
- the knowledge about a human, especially as a subject constituting social structures and their functioning rules, and those who work in these structures,
- the knowledge about the norms and rules (legal, organisational, moral, ethical) which organize the social structures and institutions and regularities which rule them and their sources, nature, changes and the ways of acting,
- the knowledge from the range of industrial property protection, copyrights and typical engineering technologies,
- the knowledge about the basic methods and tools of getting data, used in fields of studies and scientific disciplines, proper for a given faculty,
- the knowledge about general rules of creating and developing the forms of private sector.

In the scope of skills:

- the ability of analysis, interpretation and prediction of the basic social (cultural, political, legal, economic) and technical phenomena in the scope of areas of science and scientific disciplines, proper for a given faculty,
- the ability to use normative systems and the chosen norms and (legal, vocational, moral) rules in order to solve certain problems from the area of science and scientific disciplines proper for the faculty,

- the ability to gain, analyse, integrate and use information from available literature, data bases and other sources in Polish, English or other foreign languages,
- the ability to present and justify one`s own opinions and judgements, to logically formulate conclusions and suggest proper solutions to certain problems,
- the ability to plan and do easy research, measurements, to interpret the achieved results and form conclusions.
- the ability to use the basic analytical, stimulatory and experimental methods to formulate and solve engineering tasks,
- the ability to understand, analyse and interpret processes and phenomena in the area of management and engineering production,
- the ability to prepare oral presentations (speeches) in Polish or English or in other foreign languages,
- the ability to communicate with the use of different techniques in professional environment and in other ones.
- the ability to do an introductory economic analysis of the undertaken engineering tasks,

In the scope of social competences:

- the awareness of completing and improving the knowledge and skills – lifelong learning.
- the awareness of the importance and understanding of out of tech aspects and the results of engineering activities, including their influence on the environment and the responsibility for taken actions connected to it.
- the awareness of validity of cooperation in a team by playing different roles,
- the awareness of responsibility for work and safely of a team.
- the awareness of defining the priorities, which serve to fulfil important social, economic and ideological issues,
- the awareness of obeying the rules of law and following the economic and ethical principles in business activities.

Modules (subjects) with content and educating methods leading to get the knowledge, skills and social competences necessary to work in the profession of a logistician, serve the realisation of the above effects.

During the bachelor degree course (the I degree studies) at university the modules are: science from the group of technical and nature subjects, i.e.: maths, statistics, chemistry, physics, materials science or biotechnology and the subjects providing social knowledge and skills i.e.: economy, law, management and marketing, as well as business ethics and information technologies.

The remaining educating modules concentrate on production management, processes, quality, work safety and techniques and automation of production, as well as finances and costs calculation. The subject called Logistics provides knowledge and abilities from the area of logistics in a company. It is put into practice at the Packaging Department with the learning outcomes directed on the knowledge about the logistics system of a company and social competences in the area of team work.

The master degree course (the II degree studies) at university at the Management and Production Engineering Studies is enriched with the subjects from the area of strategic management, integrated management systems, organisation of production systems or quality manoeuvring tools in production, as well as the technical Logistics subject, which provides knowledge and skills from the area of logistic infrastructure. The remaining education modules, which are components of the II degree studies programme are adapted to the specialisations, which students can choose among the following: management of projects in production, management and engineering production of food and management and production engineering of cosmetics and household chemistry.

### 3. CONCLUSION

The growing need for the specialists in logistics caused dynamic development of education in this area. The legal conditions concerning the educating system in Poland, determine the creation of programmes of studies by describing the desired learning outcomes in the scope of skills, competences and knowledge. In case of the occupation of a logistician, defined in occupation classification and specialisations as a specialist, in the subgroup of jobs industry and production engineers, knowledge and skills are required, in the area of social and technical science. The Management and Production Engineering Studies at the Faculty of Commodity Science at Cracow University of Economics with the defined learning outcomes and the modules (subjects) directed to get engineering competences, provides such knowledge and skills to get engineering competences. It provides the knowledge from the area: industrial engineering processes, technology, construction of machines foundations, computer support of production management and the management area of: projects, production, human resources, as well as from the scope of economic problematic aspects including: microeconomics, macroeconomics, economic-financial analysis in a company, foundations of accounting and costs controlling, logistics and many more. This field of study is very popular among candidates to universities, which contributes to the didactic offer extension by launching new specializations, among which the most wanted is the specialization called projects management in production.

### 4. REFERENCES AND SOURCES OF INFORMATION

1. Brzeziński, M. (2012). *Kształcenie inżynierów logistyki w WAT*, Logistics, 1, pp. 75-78.
2. Lisińska-Kuśnierz, M. (2012). *Opakownictwo jako nauka. Wyzwania i możliwości dotyczące kształcenia specjalistów w zakresie opakownictwa*, Wasiak, W. (ed.), *Przemysł opakowań w Polsce Stan. Perspektywy. Oferta*, Polska Izba Opakowań, Warszawa.
3. Młynarczyk, M. (2013). *10 najlepszych zawodów 2013*, [available at: [www.forbes.pl](http://www.forbes.pl), access January 18, 2014].

4. Olechowski, J. & Jabłonowski, K.(2013). *Polska, czyli logistyczne eldorado*, [available at: [www.newsweek.pl](http://www.newsweek.pl), access December 20, 2013].
5. Rozporządzenie Ministra Nauki i Szkolnictwa Wyższego z dnia 22 listopada 2011 roku w sprawie Krajowych Ram Kwalifikacji dla Szkolnictwa Wyższego, Dz. U. Nr 253 poz. 1520.
6. Rozporządzenie Ministra Pracy i Polityki Społecznej z dnia 27 kwietnia 2007 roku w sprawie klasyfikacji zawodów i specjalności na potrzeby rynku pracy oraz zakresu jej stosowania, Dz.U. Nr 82 poz. 537.
7. Stefaniak, P. (2014). *EEC 2014: Polska logistyka, czyli więcej, niż spełnienie marzeń Kopciuszka*, [available at: [www.propertynews.pl](http://www.propertynews.pl), access May 12, 2014].
8. Ustawa z dnia 18 marca 2011 roku o zmianie ustawy – Prawo o szkolnictwie wyższym, ustawy o stopniach naukowych i tytule naukowym oraz o stopniach i tytule w zakresie sztuki oraz o zmianie niektórych innych ustaw, Dz. U. Nr 84 poz. 455.
9. Ustawa z dnia 27 lipca 2005 roku – Prawo o szkolnictwie wyższym, Dz. U. Nr 164 poz. 1365, z późniejszymi zmianami.
10. Zalecenie Parlamentu Europejskiego i Rady z dnia 18 czerwca 2009 roku w sprawie ustanowienia europejskiego systemu transferu osiągnięć w kształceniu i szkoleniu zawodowym, Dziennik Urzędowy Unii Europejskiej C155/11.





