The Efficiency of the Tasks of Transport Services in the FMCG Sector

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Food sector is omnipresent in the modern world. It plays a major role in business, and is determined, above all, by lower prices and high quality. Products must be frequently provided in stores. Customers have great expectations in terms of the delivery and availability. Most important are short-term orders realisation and flexible services. The main aim of the paper is to consider two different distribution systems. The reason for this consideration is to identify which of the distribution systems is more effective.

Keywords: tasks of transport, distribution system, FMCG.

1. INTRODUCTION

The FMCG Sector, Fast Moving Consumer Goods, covers fast-moving, quickly rotating, primary goods and products. This name touches upon different industries. The food industry may be divided into 12 basic segments involved in the production and processing of foodstuffs. The following sections can be distinguished: (1) processing and preserving of fish and meat, (2) processing of fruit and vegetables, (3) production of oils, fats and drinks, (4) processing of milk, (5) production of feeding stuffs and sugars, (6) manufacture of products from the milling of cereals, (7) production of sugar confectionery, (8) manufacture of tobacco products, (9) production of food concentrates, (10) production of cosmetics, (11) pharmaceutical production selling over-the-counter drugs, (12) production of other groceries e.g. coffee, tea (www1).

Food industry companies introduce new products to the market, map technical, processing, marketing and logistical solutions, and as the upshot the FMCG sector operators are characterized by innovativeness and flexibility of action. The FMCG sector is one of the most stable industries, it features a high level of sales and a large number of distribution channels of a diversified assortment. Therefore, there is a great need for logistical, transport and warehousing services in this sector (Burduk, 2010).

The aim of this article is to analyze and assess the efficiency of implementation of transport tasks. This article is based on a review of literature and analysis of the actual data of a chosen transport company. The structure of this paper is as follows: in part 1 requirements and expectations related to transport services are dealt with, on the basis of the peculiarity of the FMCG sector and consumption trends. Part 2 comprises an assessment of the efficiency of implementation of transport tasks based on an analysis of two distribution structures (centralized and decentralized) of two different sales networks from the FMCG sector. The comparison was made on the basis of data on the number of sent pallets, number of means of transport involved, and number of recipients served. The paper is closed with a recapitulation.

2. THE FMCG SECTOR – REQUIREMENTS AND EXPECTATIONS RELATED TO TRANSPORT SERVICES

When we look at the characteristics of the primary segments of the food industry, then one can observe that: (1) there exists an assortment heterogeneity, (2) the unit price is not too high, (3) products are bought in massive quantities, (4)

products are, in fact, bought on a day-to-day basis and (5) the purchase is made at grocery stores, super- and hypermarkets. In view of the way customers take purchasing decisions, not always on a reasonable basis, food sectors producers have to continuously follow consumption trends. Buying behaviour is influenced by six consumption trends. These are: (1) fast lifestyle, (2) new family pattern, (3) demand for high quality products, (4) increased health- (5) and product- consciousness and (6) regional development (www1), (Beba, Poczta, 2014).

The fast lifestyle is a result of increased working hours and the different ways of spending little amount of free time people nowadays have. It is also due to an increase in the number of people working more than one job. Thus, consumers need a place, where they can shop quickly and easily e.g. a neighbouring supermarket – general food retailers with an area of between 200-500 m^2 or convenience stores – small self-service shops, on average approximately 60 m^2 of sales area, open at least 11 hours a day. The new family pattern stems from an increase in the number of single-person households, especially in big cities. The first and second trend create the need for shops, where one can buy ready-made dishes, and pre-prepared or take-away products. Fashion and growing demand for premium products are a result of an increase in the number of affluent people and changing behaviour patterns. The increased health and food consciousness of some types of consumers is evident. The popularity of healthy, fresh and organic food products continues to soar. This also translates into increased product consciousness. This is a result of the wide access to the Internet and expert knowledge. The growing popularity of

regional products and their quality and freshness is also important.

Transport service systems of individual assortment items may significantly differ from each other. It ensues from the specificity of a transported assortment, and that in turn prompts the transport system for the FMCG sector to be very demanding. (Kisperska-Moroń, 2010), (Chechelski, 2016). It not only integrates all participants but also helps coordinate the basic flows: of products / services, information and funds (Sitek, 2014), (Sitek, Wikarek, 2015). The fast pace of economic growth in developing countries will probably enhance the demand for goods produced in Europe, also in Poland (Romanow, Frąś & Koliński, 2015) and it creates new challenges for logistic management and in particular for transport-forwarding-logistics branch (Walasek, 2017).

The main expectation towards transport service companies is unlimited flexibility of deliveries, whilst maintaining the highest quality and lowest price of these services. It is flexibility of deliveries that is especially influenced by: (1) temporal market fluctuations, (2) variations in sales of individual assortment groups, (3) intense marketing activities which generate activity in the area of ancillary services and (4) seasonality of demand in the FMCG sector (fig. 1). On a global scale, however, the total turnover of companies from the FMCG sector, despite a high volatility and fluctuations, has seen a constant growth. Figure 1 shows a trend and seasonality graph of global demand for assortment of the FMCG sector. The graph was compiled on the basis of cumulated data obtained from two independent sales networks considered further in this paper.
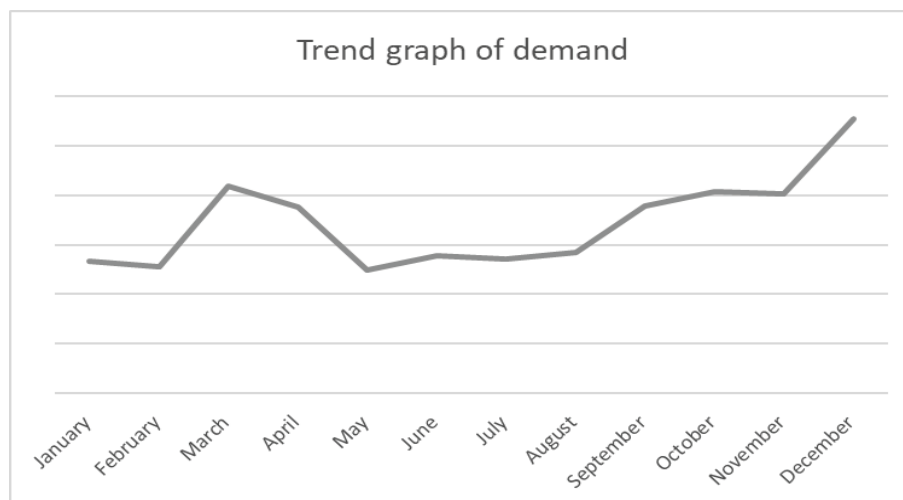

Fig. 1. Trend and seasonality graph of demand for assortment in the FMCG sector.

An important issue is the transport system. In the FMCG sector it is based on transport of full vehicle loads and general cargo deliveries. Therefore, transport companies must be flexible and have an appropriate fleet of vehicles so as to ensure reliable deliveries. In actual flows, deliveries refer to at least two (most often more than two) legally separated economic operators. In that case transport infrastructure is a network of relationships of interdependent organizations, which direct, control and streamline material flows in order to meet demand. The broad scope of relationships between different operators of the network has a direct impact on the complexity of the whole system. The higher the degree of complexity of the whole system, the greater sensitivity to interruptions (from the inside and/or from the outside) resulting in a loss of its stability. Time instability is a direct determinant of the efficiency of tasks implemented by the system.

Another important expectation towards transport services is timeliness. It is at the same time the main criterion of assessment of services. It should be

consequences of delays are high liquidated damages or (in specific cases) refusal to accept the product, the costs of which are transferred onto the contractor performing the service.

When designing and implementing task transport systems, the efficiency of the system is, above all, taken into consideration. It is the next essential criterion of assessment, this time of the degree of utilization of resources available in the different operational areas of the system (Jacyna, 2009). Rational management of transport infrastructure resources in pursuit of the set objective determines the character of relationships between elements within the system, as well as has an impact on the shape of relationships between the system and its environment. Two main distribution structures can be distinguished: with a centralized and decentralized warehousing service. The choice of the appropriate distribution structure, depends on the criteria adopted by investors. Figures 2 and 3 are schematic drawings for, respectively, the centralized and decentralized distribution structure.
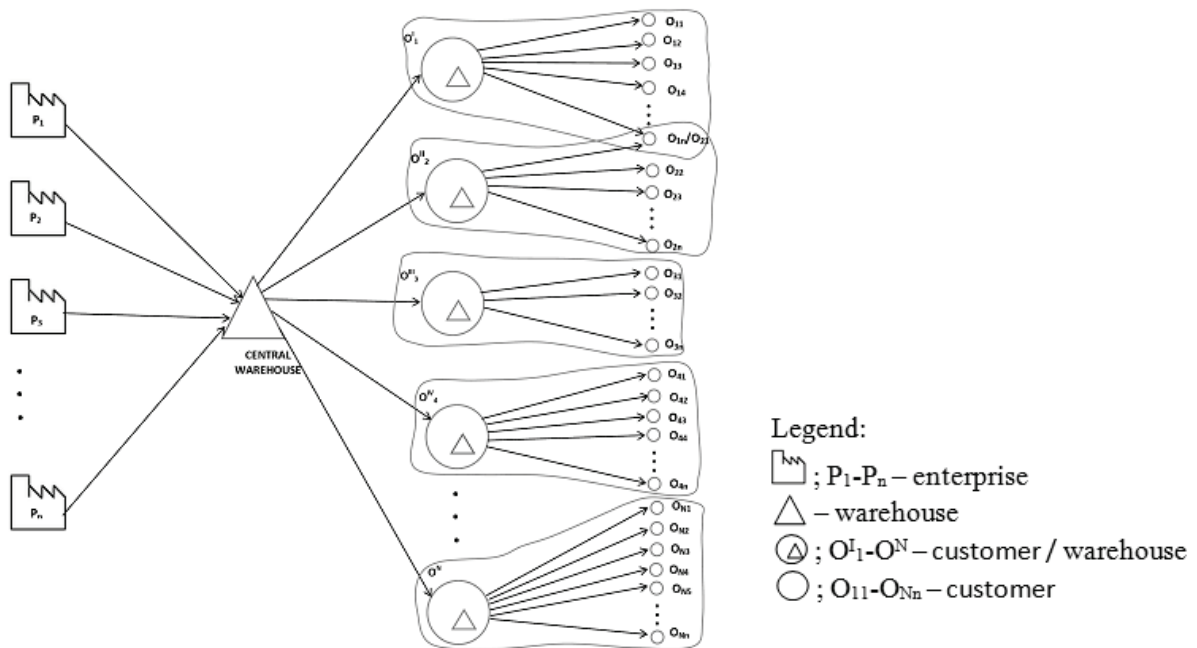

Fig. 2. Scheme of centralized distribution structure.

stressed that timeliness is a criterion which is severely restrictive for the FMCG sector. The „time windows" for quickly rotating loads delivered to recipients amount to 15 minutes. After this time, if the load has not been delivered to the recipient, the service is classified as delayed. For comparison the „time window" in the construction sector amounts to one hour (for some recipients even 8 hours). The

The centralized distribution structure is characterized by one central warehouse, most often it is a logistics centre, capable of providing comprehensive logistics services. The following services are performed in the central warehouse area: warehousing and completion of products, implementation of transport and shipping tasks, quantitative and qualitative assessment of accepted

deliveries et alia. Often enough in the central warehouse area, fulfilling the role of a shipment completion point (Grzybowska, 2009) there exists a possibility of performing cross-docking and terminal services. The key feature of centralized distribution structure is the handling of the existing demand of all recipients from one main (central) point of dispatch, regardless of the distance from the warehouse.

Unlike the centralized distribution structure, the decentralized system features several smaller (local) service warehouses. These warehouses, apart from storage services, provide goods completion services according to orders placed by recipients.

components of aggregating costs of implementation of transport system tasks are: costs of point infrastructure (inter alia warehouse and warehousing handling costs, completion and loading costs et alia) and costs of sending logistical products (materials, information, capital).

3. ANALYSIS AND ASSESSMENT OF CENTRALIZED AND DECENTRALIZED DISTRIBUTION STRUCTURES

The first system under consideration is the centralized distribution structure. For consideration purposes this system has been designated as
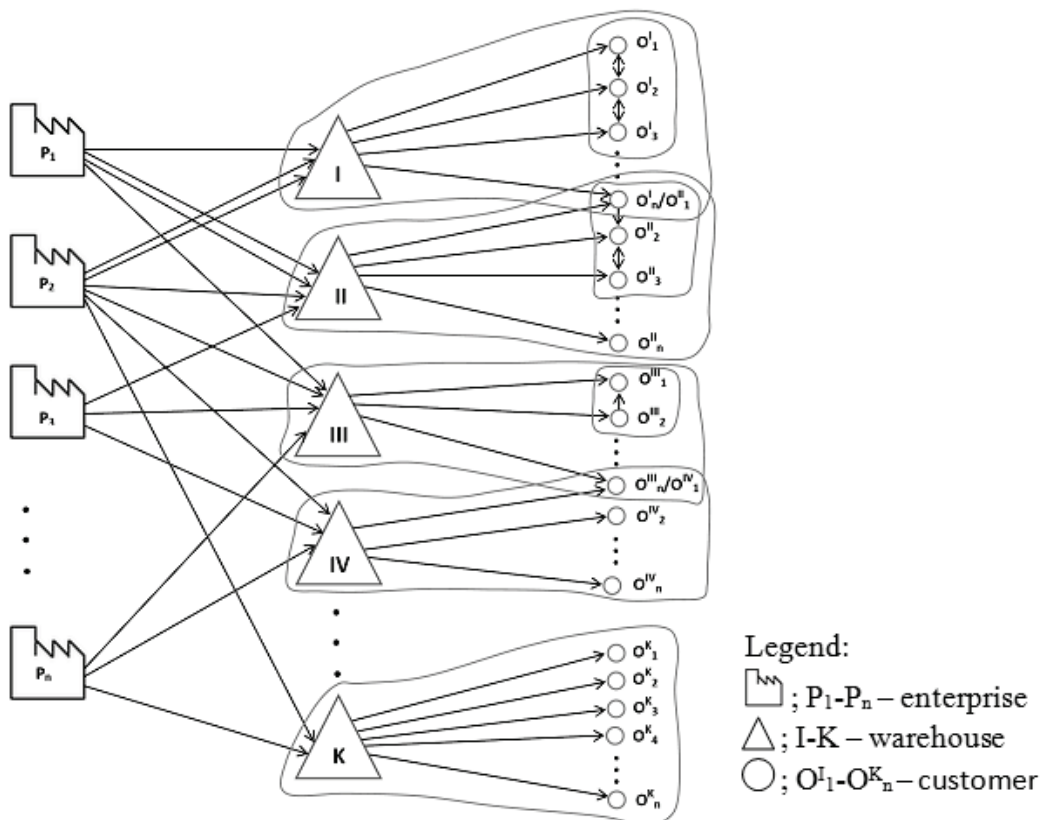

Fig. 3. Scheme of decentralized distribution structure.

The choice of an appropriate distribution structure facilitates achieving the assumed level of efficiency in a specific operation area. In order to achieve the assumed efficiency it is necessary to consider the main assessment criterion. Assessment of efficiency of transport system includes the following areas: first and foremost economy, and moreover: organization, technique and technology, quality and ecology. Analysis in the field of economic efficiency most often come down to minimization of the incurred costs of handling the entire infrastructure. The major

„Operator A". This system comprises a central warehouse, in the middle part of the country. The remit of the central warehouse includes: receipt of products from producers, their warehousing, current handling of recipient orders, completion of loading units in accordance with the demand, organization of shipment and vehicle loading. „Operator A" serves nearby shops (with an area of between 200 and 500 m^2) located in bigger agglomerations. In a free market economy the success of a company is demonstrated by its competitive advantage over competition. In order

to increase the selling radius, „Operator A" has created a franchise distribution network. Consequently, in order to reduce transport costs, nearby objects which are unloading destination points, are also cross-docking zones for vehicles with smaller capacity (12 and 18 pallets). „Smaller" vehicles bring the goods to franchise recipients (with an area of approximately 60 m^2). Figure 4 shows an illustrative scheme of location of the central warehouse and typical transport networks for the structure served by „Operator A". „Operator A" delivers goods to recipients on appointed days of the week e.g. for a typical delivery recipient deliveries may be carried out only on Tuesdays, Thursdays, Fridays and Saturdays. In the centralized distribution structure deliveries are carried out every day only to selected recipients in bigger cities (e.g. Kraków, Poznań, Warszawa). For „Operator A", within a period of one year, approximately 4% of routes with 3 or 4 unloading points have been reported. In this variant not a single case of route with five or more unloading points has been reported.

Fig. 4. "Operator A" distribution structure.

Table 1 shows the aggregate number of delivered pallets, number of used vehicles and performed deliveries in individual months of the considered year for the centralized distribution structure reflected in Figure 4. Based on the collected data the global average filling of a single vehicle amounted to 30.53 pallets. The aggregate number of delivered pallets within a period of one year amounted to 440,330 pallets and was higher by 12.8 % than during the previous accounting period. The minimum value was reached in month

XII (May), approximately equal to 28.3 pallets per vehicle, while the maximum value was reached in month VII (December), on average 32.7 pallets per vehicle. The aggregate number of used vehicles amounted to 14,323 units. As regards the means of transport involved „Operator A" has concluded contracts with seven contractors of which three companies are key collaborators, which in total perform approximately 84% of all deliveries. The scope of implementation of services between three recipients of services is divided territorially. Assignment is determined on the basis of a tender, with the main criterion being price. For each company the global average level of the KPI (Key Performance Indicator) (Zwolińska, 2014), (Zwolińska, 2012) amounts to 97.4 % of on time deliveries. During assessment of the collected data it was observed that along with seasonal growth in demand the indicator of on time deliveries was not maintained at the required level (one of the companies reached 89.7%). In two months VIII and IX KPI = 100% for each delivery reported. Such situation demonstrates under-utilization (non-maximal use) of the achievable efficiency of the existing transport structure (especially the owned fleet of vehicles).

The second model under consideration is a system with a decentralized distribution structure. A seller of goods designated as „Operator B", has many "medium-sized" points of sale scattered around the agglomeration at his disposal. The sales network covers all Poland. „Operator B" has five warehouses throughout the country, which are to receive goods from producers, perform their completion and send them to recipients. Unlike the previous case, the storage period for products placed in the warehouse is significantly shorter – up to a maximum of 30 days, for household chemical assortments up to 60 days. The shorter storage period has an impact on the higher rotation of products, and results in lower stock levels per single object. However, from a global perspective, the level of warehouse stocks is relatively higher. There is also a difference between the previous example in the frequency of deliveries to recipients. The recipients of „Operator B" have their product delivered every day. Figure 5 shows a scheme of decentralized distribution structure for „Operator B". Approximate assigned service areas and locations of distributed warehouses have also been highlighted.

Table 1. Summary figures of "Operator A" within a period of 12 months.

Lp.	Period	Number of pallets provided [pcs]	Number of used vehicles [pcs]	Number of completed deliveries [pcs]
1	Month I	30,870	1,053	1,243
2	Month II	28,830	956	1,061
3	Month III	31,250	1,028	1,151
4	Month IV	39,540	1,286	1,530
5	Month V	43,410	1,397	1,593
6	Month VI	44,960	1,427	1,613
7	Month VII	57,170	1,748	1,923
8	Month VIII	27,590	907	1,097
9	Month IX	25,450	861	1,085
10	Month X	44,820	1,425	1,639
11	Month XI	39,960	1,298	1,519
12	Month XII	26,480	937	1,246
	Sum	440,330	14,323	16,700

Fig. 5. „Operator B" distribution structure.

In the second variant, the average length of a single route is approximately shorter by 57%. The global average delivery time for „Operator B" is longer by 34% . The extension of the average time for task implementation results from multi-point unloading tasks (most often from 3 to 5) with one loading task. Routes with 1 or 2 unloading points represented a maximum 18% share in all transport tasks.

Table 2 shows the numerical values of delivered pallets, vehicles used and performed deliveries for the decentralized structure of „Operator B". During the peak demand almost two and half time as many pallets were sent to recipients. In the second considered variant there are approximately 12% fewer delivered pallets and approximately 14% smaller number of means of transport involved – however approximately 51% more performed deliveries have been reported. These differences arise from the adopted delivery timetables. In the centralized distribution structure recipients of („Operator A") do not have their loads delivered every day. In the second variant deliveries are performed to each point of sale on a daily basis. In connection with such organizational structure of deliveries, each individual transport service covers deliveries to at least 2 (or 3) recipients, whereas there are also cases of routes with 4 or 5 unloading points. In the considered variant („Operator B"), when examining each warehouse individually, it is not possible to identify the key contractors performing transport services. Each warehouse is served via a dozen of „smaller" carriers. However from a global perspective, approximately 70% of deliveries are performed by one company, which associates mainly sole traders. As regards the decentralized distribution structure, the average global indicator of on time deliveries not lower than 98.4% for each month has been reported. Such high level of deliveries was attained through the stability of individual routes. This stability was accomplished by a monotonously repetitive day-to-day cycle of using the route by the same carrier (driver).

The decentralized distribution structure ensures a high level of regularity and frequency of deliveries, but generates relatively higher costs of

Table 2. Summary of figures of „Operator B" within a period of 12 months.

Lp.	Period	Number of pallets provided [pcs]	Number of used vehicles [pcs]	Number of completed deliveries [pcs]
1	Month I	24,790	780	1,687
2	Month II	25,600	827	1,870
3	Month III	25,630	826	1,722
4	Month IV	35,980	1,144	2,223
5	Month V	38,130	1,193	2,444
6	Month VI	35,740	1,118	2,444
7	Month VII	53,850	1,654	1,766
8	Month VIII	25,770	838	1,846
9	Month IX	25,780	834	2,185
10	Month X	39,020	1,230	2,835
11	Month XI	35,060	1,104	2,544
12	Month XII	23,420	754	1,683
	Sum	388,770	12,302	25,249

operation of point infrastructure by duplicating functional tasks in each facility. Furthermore, one of the main drawbacks of the decentralized distribution structure is deficient coordination between individual warehouses. This drawback can at the same time act to one's advantage, because it does not pose limitations to adapting the facilities to local conditions. It also should be taken into account that along with the increase in the number of facilities the coordination difficulty level also increases.

4. SUMMARY

The main criterion of assessment of the efficiency of operation of the actual transport structures is profit and loss account. Achievement of the assumed economic efficiency is possible, whilst ensuring the availability of products for the recipient. In the considered variants, the guarantee of benefits stemming from meeting customer needs are: in the first case („Operator A") maintaining relatively high stock levels in the warehouse center and at points of sale. In the second case to („Operator B") due to smaller shop area, it is not possible to sustain high stock levels, therefore deliveries are performed in accordance with the principle just – in – time (JIT). Supply strategy that conforms with JIT is difficult to implement and maintain and very expensive. For complex transport systems, which comprise many components and the relationships between elements are also complex, achieving short

response times to the existing demand is very difficult. Therefore in the second variant in order to obtain short delivery times, the overriding network system has been decomposed into five independent subsystem that serve the assigned area. The separated subsystems, which are independent organizational units, perform tasks in isolation from the overriding system. In two different distribution structures considered, having the same territorial scope and similar annual demand („Operator A": 440 330 pallet pieces; „Operator B": 388 770 pallet pieces) there are identical indicators of measurement of transport service quality. Regardless of the structure, enterprises (contractors) must guarantee a flexible and comprehensive service and high quality of services, in order to able to meet the changing expectations of recipients of the FMCG sector.

Rising global trade has generated a higher demand for logistics services, since it leads to larger conveyances and higher conveyance utilization. The solution to this problem may be the agglomeration of logistics firms or logistics clusters. The studies of industry clusters (Marshall, 1920), Porter (1998), (Macchion et al., 2015), (Morris et al., 2004), (Yusuf et al., 2014), (Rivera, Sheffi, Knoppen, 2016) indicate: co-location he identifies increased productivity, new technological and delivery possibilities, easier access to information, ease of new business formation, and benefits rooted in working together with other institutions. Automatic identification,

neural networks, genetic algorithms, ant colony algorithms help find the optimal solution, and thereby to optimize the use of resources (e.g. human, material handling machines, transport machines, transport routes etc.), and to reduce the pollutants (Grzybowska, Kovács, 2014).

REFERENCES

[1] Beba P., Poczta W., Rozwój i rola polskiego przemysłu spożywczego w warunkach akcesji do Unii Europejskiej, Polityki Europejskie, Finanse i Marketing, 11 (60) 2014, pp. 7-18.

[2] Burduk A., 2010, An attempt to adapt serial reliability structures for the needs of analyses and assessments of the risk in production systems, Eksploatacja i Niezawodność – Maintenance and Reliability, No. 3, pp. 85-96.

[3] Chechelski P., Korporacje transnarodowe w polskim przemyśle spożywczym, Przemysł Spożywczy, 2016, T. 70, No. 9, pp. 2-7

[4] Grzybowska K., 2009, Podstawy logistyki, Difin, Warszawa

[5] Grzybowska K., Kovács G., 2014, Sustainable supply chain – supporting tools, Preprints of the Federated Conference on Computer Science and Information Systems, M. Ganzha, L. Maciaszek, M. Paprzycki (eds.), pp. 1351–1359, DOI: 10.15439/2014F75

[6] Jacyna M., 2009, Modelowanie i ocena systemów transportowych, Oficyna Wydawnicza Politechniki Warszawskiej.

[7] Kisperska-Moroń D., 2010, Model systemu dystrybucji w Polsce w aspekcie komodalności transportu towarów, Prace Naukowe Politechniki Warszawskiej. Transport, pp. 55-79.

[8] Macchion L., Moretto A., Caniato F., Caridi M., Danese P., Vinelli A., 2015. Production and supply network strategies within the fashion industry. International Journal Production Economic, 163, 173–188.

[9] Marshall, A., 1920. Principles of Economics. Macmillan, London.

[10] Morris D., Donnelly D., Donnelly T., 2004. Supplier parks in the automotive industry. Supply Chain Management, 9, 129–132

[11] Porter M., 1998. Clusters and the new economics of competitiveness. Harvard Business. Review, 76, 77–90.

[12] Romanow P., Frąś J. & Koliński A., 2015, Container transport in Poland in logistic supply chain, Research in Logistics & Production, No. 1, pp. 43-51.

[13] Sitek P., A hybrid CP/MP approach to supply chain modelling, optimization and analysis, Federated Conference on Computer Science and Information Systems (FedCSIS), pp. 1345-1352, 2014. http://dx.doi.org/10.15439/2014F89

[14] Sitek P., Wikarek J., A Hybrid Approach to the Optimization of Multiechelon Systems, Mathematical Problems in Engineering, vol. 2015, pp. 1-12, 2015. http://dx.doi:10.1155/2015/925675.

[15] Yusuf Y., Musa A., Dauda M., El-Berishy N., Kovvuri D., Abubakar T., 2014. A study of the diffusion of agility and cluster competitiveness in the oil and gas supply chains. Int. J. Prod. Econ. 147, 498–513

[16] Zwolińska B. Ocena usług spedycyjnych według wskaźnika KPI — Rating of shipping services by KPI, Logistyka 2014, nr 3, s. 7123–7130, Poznań 2014, ISSN 1231-5478,

[17] Zwolińska B., Key performance indicators (KPI) of transport services assessment, Carpathian logistics congress: 7TH – 9TH November 2012, Jesenik, Czech Republic, s. 58, ISBN: 978-80-87294-33-8

[18] Rivera L., Sheffi Y., Knoppen D., 2016, Logistics clusters: The impact of further agglomeration, training and firm size on collaboration and value added services, International Journal of Production Economics, Vol. 179, pp. 285-294.

[19] www1, POLSKI RYNEK HANDLU SPOŻYWCZEGO W 2010-2020 ROKU, Listopad, 2016, https://www.rolandberger.com/publications/public ation_pdf/polski_rynek_handlu_spo_ywczego_w_ 2010_2020_szczeg__owa_analiza_segmentu_conv enience_i_supermarket_w_proximity.pdf.

[20] Robert Walasek, Effectiveness of intermodal transport in Poland – results of the study, Research in Logistics & Production, Vol. 7, No. 2, pp. 159–170, DOI: 10.21008/j.2083-4950.2017.7.2.8.

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