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THE BUSINESS PROFILE SHAPING AND THE LOGISTICS INFORMATION SYSTEMS OF 2PL, 3PL, 4PL OPERATORS

Introduction

Before detailed presentation of the research results there is necessary to characterize briefly differentiating features of 2PL, 3PL, and 4PL operators and some factors affecting the use of IT systems by these firms. This one helps with better uderstanding of operator's classification based on identifying the core of activities[*].

2PL operator is logistics service provider which focusues on commodity capacity providing. This means that a firm called "2PL operator" focuses on basic logistics activities like transportation, warehousing, transshipment and provides services relating to these logistics areas. The scope of the core business of 2PL is tight. The main reason for the use of 2PL operators by firms is tending toward minimum operational cost of a logistic system and avoiding of costly capital investment. 2PL operators do not need advanced IT systems for coordinating their activities within the logistics systems and/or the supply chain (this sentence not means that 2PL operator doesn't use IT solution and software at all).

3PL operator, sometimes may be called "lead logistics provider", is a logistics provider of intgrated logistics services. This sentence means that: 3PL is a firm that provides service to its customer (the service is outsourced by the customer and very often long-term contract must be signed), services can be adapted to a particular customer, logistics services are integrated and boudled together by the operator, 3PL provides first of all transportation, warehousing, cross-docking, inventory management, packaging, tagging services etc. Very often the services go beyond standard logistics activities – like information services and optimalization/planning of logistics activities. In this situation 3PL becomes "a consulting company" for the customers. The firm called "3PL" usually uses advanced IT solutions for coordinating and managing of logistics activities within the supply chain. Main areas of using computer systems and software are related to: inventory and logistics management (inter alia – freight consolidation, shipment planning, traffic management, ordery management, carrier selection, inventory planning, and management), customer service (inter alia – order management, auditing of deliveries, fullfilment, carrier selection, help desk – sometimes solution related to on-line connection with customers), transportation (inter alia – fleet management, routing, planning and cross docking management, returns – management and control), warehousing (inter alia – packaging, labeling, capacity planning, and control). Within all these areas total logistical cost calculation and optimization has been usually applied.

4PL operator has been described as the integrator of the supply chain (both – up-stream and down-stream logistics activities). Some main factors can help with

[*] This part of the paper is based on: (WWW3; WWW 1; WWW6; WWW7).

identifying 4PL firms. The first one is related to the coordination of all activities of 3PL operators existing within the supply chain; in this situation 4PL firm is "virtual coordinator" of the supply chain and focuses on planning and management functions. The second one is connected with the factor that usually 4PL operators are "non-asset based logistics providers". This one means that 4PL operator focuses on virtual planning of operations and optimizing them. Planning has been supported by advanced IT and softwaare solutions. 4PL usually optimizes the whole network – the flow of good based on "real-time" information.

1. Information about the course and nature of the research

This study is the result of research on selected aspects of business development and logistics information system of operators. The research period is September-November 2011. The general objectives of this study was to gather information on: the impact that logistics operators may potentially have on the functioning of the information exchange field; the type of data available in the logistics information systems; identifying the types of IT and telecommunication tools used by a certain operator.

Specific objectives of the study were associated with determining whether there are barriers associated with the development of logistics operators and what areas they relate. The focus was on the barriers connected with the operation of information systems supported with IT technology. An attempt was taken to identify how the operators evaluate the aspects related to the functioning of their information systems and what is the knowledge on the impact of information systems on optimising the submission and execution of orders and estimating the costs of the operator. The study was conducted on the basis of the case study method. Case study was also supported by direct interview with the specialists employed by the operators and by the analysis of operators' websites. Questions and answers sheet was used in order to standardize the research material gathered from provided responses.

The questions were of the following nature. The first group consisted of general questions, which were related to a company's characteristics (the scope of its activities), performed tasks, structure of the company. The second group of questions was related to information technology solutions used in a firm. First of all, it was to identify whether and what type of software the company applies, or whether ICT solutions, integrating all activities in terms of orders processing are applied[*] The third group of questions concerned the operator's customer support

[*] The main objective was to determine whether, and under what actions, an integration of activities in the cycle of orders submission and execution is possible.

for the selection of software, processes mapping, or the exchange of know-how used in actions integration in the cycle of orders submission and implementation of automatic identification tools. The fourth group of questions concerned the costs. The essence of the questions was to determine whether a certain company collects, in its system, information on costs related to the implementation of contracts in a continuous manner; what areas the costs can be attributed to; whether on the basis of the appropriate grouping of costs the profitability of orders, specific routes or areas service can be estimated; if the level of service delivery can be determined, and whether the level of costs and its fluctuations can be observed continuously. The fifth group of questions concerned the use of Web pages in the activities of operators, types of software and the use and knowledge of EDI standards. The sixth group was associated with, made within 2-3 years, changes in the information systems functioning – the question was whether the changes have taken place at all, and whether they are planned in the same period in the future. The seventh group of questions was related to obtaining information on the experts' subjective assessments on the importance of planning activities in the logistics system; the prevention of emergency or undesirable situations, and decision-making by top management in a year or longer. The experts were also to express their assessment associated with provided statements[**]. The aim of the question was to investigate whether the respondent (a company) sees the relation between these elements and the possibility to achieve a synergy effect in the company's activities by an appropriate combination of them (receiving and execution of orders, deliveries, an impact on the quality of operations, planning), or whether they are completely distinct areas. Participants also had to decide whether they agreed or not with certain statements, giving them adequate Lickert scoring scale. They were also asked to explain briefly why they chose a particular answer[***]. The eighth group of questions is a so-called impressum. The questions were related to company size, geographic area of business, the company or branch office, as well as how the

[**] There were a few of these statements. One of the questions contained, divided into two variants of the answer, various aspects of a comprehensive formation of logistic service. The first variant (a) included such items as: company image, price flexibility for delivered services or sold products, the competence of people in contact with the client and executing sales, introducing the customer suggestions in the company. The second variant (b) was related to the accuracy of services, speed and flexibility in operation, developing IT systems, information exchange in real time between suppliers and customers.

[***] The analysed statements were as follows: "1. Today, customers are more interested in a particular logistics service provider, than a service provider is interested in a particular customer", "2. Your company processes the logistics functions much better than other logistics service providers", "3. Logistics service providers operating in Poland offer the same level of services as the one in other European countries and the world", "4. The level of logistics services offered by your company can still be improved with relatively low expenditures on the IT system", "5. Our company has a very good IT system used to the full extent in the cooperation with other companies".

specialist classifies the company – whether it is the 2PL, 3PL or 4PL operator. The research results on individual operators are presented below.

2. Research results

2.1. First case characteristics

This paper will present the results obtained from cases examination of three logistics operators. The companies (operators) adapted to the study are in the rankings of "Top 500" for the years 2004-2006, 2005-2007, 2009-2010[*].

The first operator is a company classified, according to an expert opinion as a medium-sized enterprise. Analysis of data contained on the operator's website confirms this statement because of the number of employees as well as self-owned stock. The company's activities cover Poland and Europe. In the answers provided, it was identified as the 2PL operator. Analysis of the information posted on the company's website does not allow to unequivocally state that the company is the 2PL operator. The company may in fact seek to focus on the chosen niche and, even being the operator of 3PL or 4PL even, implement certain functions traditionally attributed to all 3PL operators. Headquarters of the firm is located in the voivodeship of Mazovia, and the examined branch in Silesia. Company is engaged in freight forwarding and transportation. The company has several branches, in which the forwarding tasks are performed. There's the company's common policy, for planning costs and customer service for all branches, determined by the headquarters. As for the tasks performed in the course of the order, the firm itself does all the tasks related to the implementation of logistics (orders adoption, scheduling, cost optimization, purchase, etc.), from placing the order by the client/customer, to delivery. However, this concerns freight forwarding actions. While implementation of certain deliveries, the company passes to outside carriers. This information is confirmed on the company's website.

Regarding the use of IT tools and telecommunication, the company uses ICT network, which includes mobile phone network and transportation management by an integrated GPS system. The system determines the travel time, fuel consumptions analysis, supervision of the safety-transported goods. The company also provides software (e.g. by web or direct contact and by providing devices) to support the tasks and the execution of contracts/orders. The company conducts continuous analysis of the costs associated with orders fulfilment, transportation and supply, complaints and their causes, and finally the costs for delayed delivery. Costs can be assigned to customer orders, routes or service

[*] Verified with other information provided on web pages: (WWW8; WWW4; WWW2; WWW5).

areas in order to optimize the supply, the calculation of profit or loss. Customers can place orders by the Web-form, they can also track shipping space on the Web page. The company uses ERP and CRM software, but does not use EDI standards. The IT system was not changed in the last 2-3 years. This is an important result of the research. Although a company uses integrated software, it may not fully exploit its capabilities and functions that enable the introduction of standard electronic messages such as ANSI, EDIFACT, etc. Interesting marks appear in the importance of information flow for planning activities in the logistics system (score 6)[*], prevention of emergency situations, undesirable (score 7) and decision-making by top management through 1 year or more (score 3). These results may suggest a lack of recognition of the importance which occurs between planning activities and their implementation regardless of the level and time horizon. In addition, the difference (though small) between the assessment of planning activities in the logistics system, and prevention of emergency situations may suggest that more important than planning is the performance of current activities, or the need to focus on the elimination of factors and undesirable situations (positive aspect). A positive fact is that both elements were highly evaluated, what suggests noticing a close link between them (good activities planning can eliminate some errors and emergencies).

The question concerning the importance of contrasting factors such as company image, price flexibility for services provided or sold, etc. (variant a.) and flexibility in operation, developing information systems, exchange of information in real time, etc. (variant b) a respondent stated that he or she would have chosen option a. and b. However, in the absence of alternative, variant b. was finally chosen. This demonstrates the awareness of the correlation of all mentioned elements. The essence of the question shows that the factors in variant a. are achieved somehow "automatically," if the factors from group b are accomplished. The answers to a question, which included the Lickert scale[**], were assessed sequentially, according to a scale: 1, lack of answer, 5, 4 and 2. The results show contradictory answers. For example, low rating of statement 1[***] is accompanied by very high rating of statements 3 and 4, and low for statement 5.

[*] The evaluation was on the scale from "1" to "7", where "1" meant the lowest, and "7" – the highest grade.

[**] According to the statements given in footnote 3.

[***] The surveyed subject strongly disagrees with the statement "Today, customers are more interested in a particular logistics service provider than the service provider is interested in a particular customer;" he or she strongly agrees with the statement "Logistics service providers operating in Poland offer the same level of services as the one in other European countries and the world" and agrees that "Offered by your company level of logistics service can still be improved with relatively low expenditures on the IT system," and also does not agree that "Our company has a very good IT system used to the full extent in the cooperation with other companies."

2.2. Second case characteristics

The second of the studied operators is a large enterprise. It is the operator of 3PL. However, you can point out the areas in the company that in literature are indicated as features of 4PL operators[*]. The company operates globally. The headquarters is located in the Wielkopolska voivodeship, and the examined branch is situated in Silesia. The company has several branches. The company provides services to small, medium and large enterprises that decided on comprehensive outsourcing of logistics services. The company provides services in freight forwarding, transport and storage of products. Together with the client, the company determines the terms and conditions of storage and completion of products (even for individual orders and goods), analyses the stages of work together with the customer. Product labelling (e.g. bar codes) is not done for the customers. Headquarters make strategic decisions for all departments (purchasing, analysis and planning of the costs level, scope and level of customer service). The company owns and handles itself its own supply network across Europe. Among the activities of tasks performed by the company that should be mentioned at first, there is a contract logistics, warehousing, transportation, including international one, freight forwarding by sea and air. The company performs its own tasks related to deliveries. However, there are areas where it uses external services – most of all in terms of external drivers in the FTL delivery, and warehouse staff (staff outsourcing). The company also leases and manages the warehouse space. The company has an ICT network – computer network and other telecommunication devices forming a coherent system (e.g. mobile network). For example, the use of electronic tools includes mobile phones which the drivers use to send a message regarding confirmation of delivery after delivering the consignment.

The company's activity is not limited only to providing transportation or storage. The company helps its clients/customers/suppliers in choosing the right software in order to accelerate and automate the implementation of contracts/orders and the corresponding data compilation and information exchange; it provides software (e.g. web or direct contact and providing the devices) to support tasks and fulfilment of contracts/orders; it shares the ideas, e.g. in the form of meetings and exchange of information on implementing a comprehensive system for orders placing, deliveries, and automatic identification of the reception and deliveries. The company conducts continuous analysis of the increase or decrease of the costs level. Cost can be referenced to contracts/orders, routes or service areas, and they can be assigned to internal orders to determine the level of service delivery.

[*] See annotation 4.

Regarding the use of a web page, all customers can place orders in the Internet, they can also control the implementation stage of the contract and delivery by the web (if they have the payer's order number for the consignment). Ambiguous enough is the answer about the EDI standard in the company. Although the answers were that EDI was used, it was not possible to determine what the standard was. Further analysis and the provided answer concerning the type of software which has been used suggest that it can be a standard based on the ERP and CRM system. The system is used for a comprehensive vehicle management. This includes such activities and areas as: the entry and exit control of means of transport, logistics controlling, return logistics, optimization of logistics costs, planning and optimization of loading, route planning and shipments scheduling, RFID, wireless technology (including mobile technology), Transport Management System, Warehouse Management System, management of supply security, international trade management, relations with suppliers management, orders management and inventory management. However, not all of the elements integrate all activities in the chain. It confirms the answer that within the next 3-5 years an integrated suite supporting the management of delivery chain would be needed. A fundamental change of the system functioning (2-3 years ago) concerned the introduction of the program to enter the orders by customers.

The respondent emphasized the answer relating to activities planning in the logistics system (7 pts.), emergency or undesirable situations prevention (7 pts.) and decision-making by top management in 1 year or longer (4 pts.). In the context of analysis of all activities carried out by the operator and the functioning of the solutions in the IT system, it may mean that planning for shorter time and flexible response to current changes based on the data in real time are essential elements of success in implementing tasks and logistics operations. The function of planning by the top management should set a general, long-term framework for business. This does not automatically mean that the long-term planning is less important. It, however, begins paying "a supporting role".

Interesting data also comes from answers to the question on determining the value of contrasting factors such as a company's image, price flexibility for services delivered or sold, etc. (variant a) and flexibility in operation, developing information systems, exchange of information in real time, etc. (variant b). According to the specialist providing the answer, how the company is perceived in the market is reflected in the position it occupies; the price flexibility provides greater opportunity for trade negotiations, which entails more sales; proper and competent staff is one of the most important value of the company, the pro-client attitude enables to enter customer suggestions. Hence, an indication of point a. as a group of major factors. It can also be stated (information provided in the

course of the research) that the given answer basically refers to the need to implement the items listed in point b. As for the questions, where the Lickert scale was used, they were assessed sequentially according to the scale: 1, 2, 4, 3, and 4. Interpretation of the selection is as follows. According to statement 1*, a service provide is more interested in the customers (particularly those large contract ones, for which individual projects are carried out); in case of statement 2: a company tries to perform logistics functions as well as possible, but it should be noticed that there are areas where it will stand out as a leader in the market and vice versa – competitors will be the leaders in other areas; the third statement: the level of domestic and foreign service providers is comparable, the only exceptions, and obstacles at the same time, in obtaining the same level, may be legal regulations; the fourth statement: the company continuously improves the IT system with additional modules for the new services introduced for newly acquired customers; the last statement, fifth: from the point of view of an operation worker, the system is fully used to co-operate with the client.

2.3. Third case characteristics

The third examined operator is a company which main scope of services is set by freight forwarding business, but also advanced storage services. The company has several branches in Poland and it is connected with an international company. Its domain actions are freight forwarding services, organization of transport services, periodic storage, including reloading and completion, additional services provision such as product labelling and advising the client on selecting a route optimization and method of delivery (for example, you can optimize delivery through consolidation, change the route, etc.). The company uses other entities in the tasks implementation, including in particular the transport companies (it can be noticed in its basic range of activities, as a shipper and delivery of cargo organizer). The company may be qualified as a large company operating in Poland only. The company was described as 4PL operator. The feature that proves it is the lack of fixed assets for the direct implementation of logistics (implementation of physical delivery) and organizing this operation with the involvement of other entities. Headquarters is located in the voivodeship of Mazovia, and the examined branch is situated in Silesia.

The opinions expressed by a respondent in an interview on the operation system, telecommunication solutions, Internet application and supporting customers by additional services and activities, are as follows. The company uses, on a limited scale, IT solutions for customers' orders. They are used to a full extent

* See footnote 3.

only in the implementation of national groupage transport. The company has never helped their suppliers/customers in the selection of software for order processing, processes mapping; it neither offers software via website nor supports the logistics activities and placing orders via website. With the additional examination of the operator's website, it can be stated that the provided answers for the information sharing via website (in particular services orders and shipment tracking) are correct with the facts given by the person interviewed (website contents in December 2011). After web searching it can be stated that there are traces of a system enabling the company's customers to place orders via web page (there is a booking system via web, track & trace system, and an internal Intranet). Although the subject stated that these solutions are only available for a specific group of customers and deliveries, a positive aspect is that it is possible to qualify the operator as a 4PL provider. However, what should be remembered is the fact of previously reported claims and the lack of possibility to clearly identify the actual facts. Perhaps the operator was of a 2PL type and it is currently evolving towards 4PL. Additional explanations, given by a participant of the research, in terms of the IT system functioning seem to confirm this assumption.

Interesting are the answers concerning the costs identification and data collection in the relevant sections of the computer system. Although the answer given was that the company collects data on costs related to orders processing, transport, delivery, and storage, but above all, in the opinion of the respondent these are classic terms of accounting; the expenses are not directly related to the logistics processes (orders, deliveries, transport). Detailed data on costs, however, is related to the delayed deliveries. This demonstrates the possibility of obtaining this type of detailed data in the system. However, they are probably not connected with the current decisions and operational actions in any way. They are not used by professionals in their daily work or they are but only by certain positions[*]. Thus, the answer to the question whether the company is able to investigate or applies continuous analysis, which allow to specify the degree of decrease or increase in a certain group of costs and associate them with the increase or decrease in another group of costs, was negative. Another feature is the presence of a system with integrated IT system characteristics, but it cannot be determined whether and what EDI standards are present in the company. It is not known what areas are integrated and supported in the IT system (lack of knowledge and vision of the examined person). The importance of activity planning in the logistics system, however, as well as the undesirable emergency situations prevention and decision making by top management in 1 year or longer, were graded with the highest number of points (7 points). According to the expert's opinion, it is necessary to integrate all the operations in a cycle of an

[*] Assumptions could not be clearly verified.

order and delivery processing, regardless to the time scale. The whole vision of the examined person is also confirmed by an answer in the question regarding the value of intentionally contrasting factors such as a company image, price flexibility in terms of services provided or sold, etc. (variant a) and flexibility in operation, development of IT systems, real time exchange of information, etc. (variant b). The answer relates to the choice of variants a and b. While the answers to the questions, for which the Lickert scale[*] was used, were evaluated in sequence: 2, 4, 4, 4, and 2. the interpretation of the choice is as follows. With regard to a statement 1[**], a logistics service provider is forced to take the competition fight, since there are many subjects of high quality services; statement 2: it is about the individual, implemented by the company, approach towards the customer; statement 3: a similar level of subjects' services in Poland and abroad is proved by their actual level and the customer evaluation; statement 4: what results from the opinion of employees, is that it is necessary to improve the Internet solutions; statement 5: the need to improve the IT system is proved unsatisfactory data, the need to improve the track & trace system.

Conclusions

According to the research in mentioned companies, which are logistics operators, we can point out:

1. A diverse range of activity of companies identifying themselves as operators 2, 3 or 4PL. It seems that the diversity arises from the need to adapt by a certain operator to the requirements of the various entities serviced. This element is the main determinant of the undertaken activity direction. Less commonly, the scope of activities is a result of reliance on the analysis of the operator's so-called "core competence" and a development of it. It can be assumed that the competence, the most important for the operator and standing for its advantage, "form" in the course of gaining practical experience and crystallization of its operation concept (evolution). The competence is not always formed as result of deliberate and conscious planning of activity in relation to the logistics sphere or performed tasks; a long-term behaviour is not always adopted in order to use it practically. Thus, in practice it appears difficult to clearly qualify the company as an operator of 3/4PL or 2/3PL type. What is interesting in this regard, is qualifying two different companies of similar profiles and a scope of activity (the first and the third one in the research description) once as a 2PL operator, and in the second case, as a 4PL operator.

[*] According to the statements given in footnote 3.
[**] See footnote 3.

2. A varied level and scope of the IT solutions. In all of the studied cases there is probably a large gap between the integration of the company development planning and the development of its IT system. Although the level and scope of IT solutions may vary and it does not constitute a negative feature, it seems that two elements play the primary role in the evaluation of the IT solutions effectiveness. The first element is the system connection of all activities in the process of implementation of the customers orders/contracts and linking the operator's systems with the systems of its customers. This condition, as studies show, is not always true or it allows full exchange of information in real time. The second element is a possibility of costs estimation in the process of ongoing activities related to the contracts implementation in order to optimize the delivery routes and making decisions related to the consolidation of cargo, etc. The analysis of the obtained results shows that these conditions are not fully met by the operators yet.
3. A lack of full application of the submission cycle concept and orders processing (related to point 2). The obtained results allow to conclude that, in fact, this concept is not known at all or it is not used in the operations of companies that are partially operators. This may have serious consequences in the implementation and development of computer-supported information systems.
4. Gaps in obtaining the cost information at any cross section desired in order to make appropriate decisions.
5. Lack of information whether a certain operator sets the EDI standard.
6. Not all operator companies provide full support to their customers (including the re-engineering processes in the area of logistics). The action to improve the efficiency of the materials physical flow, for example by mapping existing processes, exchange of know-how and experience, logistics consultancy, etc. is not being implemented almost at all.
7. The level of the respondents knowledge and awareness of the use of IT solutions, which support the processing contracts/orders, tracking shipments, etc. (lack of an overall vision of the whole system operation) is varied. Some of the answers seem to be inconsistent with the facts. In fact, the information provided in the direct research, and verified on the certain operator's website, demonstrate at least a trace of existence of integration in the information exchange, e.g. in the case of the third of the operators and the possibility of orders processing by the web.

These conclusions do not generalize the status quo. They are the observations of the obtained research results. These results, in relation to set goals and objectives of research, involve identifying the potential barriers in shaping the development of logistics operators and companies which are their customers.

Regardless of the type of an operator (its maturity and stage of development) there are problems associated mainly with the creation of a clear and coherent vision of the development and application of specific IT solution suited to its needs, the know-how knowledge, the range of applied solutions and their impact on operational activities. It is also important to support this development with the appropriately shaped knowledge and the development of skills of personnel in the enterprise. However, other conclusions also arise. Barriers and gaps in the functioning of the operators will always occur due to the limits resulting from the knowledge and skills, because of the capital constraints, and also because of the strong competition in the TSL sector. Some of the subjects, consistently pursuing its vision and plans for the development, achieved and continue to develop an appropriate range of services using the knowledge and tools in the form of IT systems and telecommunication. An example of this type of companies is the operator described in section 2.2.

Comparing results of of the research with the newest information related to this research field in the world some conclusions have joints[*]. First, activity fields of operators has been broden for the last years. It menas that logistics service providers try to provide services adjusted to the customers, meeting at the same time the global scale of operations (in many cases) and very high service level for customers. Second, today operators (especially 3PL and 4PL) are not only physical services providers, but set up new activities especially related to providing accurate logistics information in real time. For this reason, 3PL and 4PL operators in the world use advanced information systems, concepts and supporting software to obtain competitive advantage. Third, comparing the scale of practical application IT systems in polish firms (operators) described in the research with leading solutions in the world is rather difficult to say that the level of using IT technology is better or worse. But probably more attention should be paid in the nearest future in Polish firm (operators) relating to implementing and developing of IT systems for supporting logistics activities. The result should be visible for example in increasing level of logistics management (because of better integration and coordination logistics activities within supply chain, lower total cost).

The questions included in the question spreadsheet, along with explanations for the respondents[**]

1. What group of entities can your company be included in? Please respond describing the activities of your company most fully (3-4 sentences) *[e.g. shipping company, trans-*

[*] See foodnote 3.

[**] Explanations regarding questions have been given in brackets "[…]"

port-forwarding company, warehouse services company, company providing all the services mentioned in the point above, the IT service provider in terms of logistics, providing services in the field of inventory management, company operating in the [specify here] industry, a customer using the services of logistics (transport, or others), none of the above answers characterized our company properly].

2. Does your company have a network structure? Indicate whether there are headquarters that make decisions for the entire enterprise-network or whether decisions are made independently in different branches, subsidiaries, etc., and what these decisions concern mainly (e.g. possibility of cargo delivery by each branch independently of headquarters, but the purchasing decisions, the common cost or customer service policies- determined by the Headquarters) *[In reply: Yes, for example, several warehouses, transport bases, etc., or not – a single company, one production plant, etc.]*.

3. What is the scope of your business? *[Hint – you can choose one of the answers below: Our company provides transport services, Our company provides forwarding services, Our company provides range of services: interim storage of goods, their handling, completion, etc., Our company provides services such as transportation, warehousing, but also the additional functions e.g. related to packaging and labeling of products, All of the above statements fit in with our company, and additionally, e.g. advising a client, for instance, in order to optimize the route and method of delivery, Our company carries out the operations described earlier, but also advises on the optimal batch delivery, number of deliveries at a time to the customer, type of packaging used should be, etc. Our company has optimized all steps in the supply chain for clients / customers, After receiving an order our company optimizes the delivery from our point of view and performs certain standard activities related to the reception, release and delivery of the goods]*.

4. Does your company independently perform all the tasks related to the delivery or performance of other logistics tasks (acceptance of orders, scheduling, cost optimization, purchases, etc.), from placing the order by the customer / recipient, ending with the delivery*? [Yes, no or I do not know, or any other comments; also look at the question 5]*.

5. Does your company independently perform all the tasks related to the delivery, from placing the order by the client / customer, through the delivery, but other entities handle the selected tasks and activities? *[For example, these may involve (select up to three areas that most fully describe the actual operation, or describe in your own words) Transport (other transport companies), own transport, but the hired driver, Freight, Reception, releases, completion (staff outsourcing) operations, Storage area / warehouse management, IT network operation surveillance]*.

6. Does the company use information technology and various types of software with the aim of completing orders from customers / users (choose one of the most complete answers)? If so, what type? *[For example, it may refer to: Information system and computer network, Telecommunication network (computer network and other telecommunication devices forming a coherent system, such as mobile network), The company does not apply advanced IT solutions, it is not necessary; The company does not use such solutions, as a considerable number of the customers / suppliers / consignees are not interested in such a solution, The company applies IT solutions but not to all its activities (state what it embraces and what not)]*.

7. If in the question 6 the answer "Telecommunication network (computer network and other telecommunication devices forming a coherent system, such as mobile ne-

twork)"was indicated, what exactly constitutes the system outside the computer network (up to three areas, most fully describing the actual elements of the system)? *[E.g. solutions and electronic tools (scanners, pagers, other - what?)]*.
8. Has your company helped its clients / customers / suppliers (give one or max. 3 answers most fully describing the actual elements): In the selection of appropriate software in order to accelerate and automate the implementation of commission contracts / orders and compiling relevant data and information exchange; Provides software (e.g. via a website or direct contact and access to the media) supporting the tasks performance and fulfilling commission contracts / orders; Provides other ideas, such as meetings and exchange of information on implementing a comprehensive system for placing orders, effecting deliveries, automatic identification of the receiving and releasing; Helped in the mapping processes in order to obtain their optimal flow and standardization; Not helped in any of the areas listed in paragraphs.
9. Does the company continuously collect the following data in the computer system (specify any number of responses, most fully describing the actual elements): Data on costs associated with order fulfillment; Data on costs associated with the transportation, delivery; Warehousing cost data; Data on costs of complaints and their causes, Delayed deliveries cost data.
10. Can the individual cost data be attributed to (select any, the most comprehensive answers): Customer orders, e.g. to calculate the profit or loss incurred on the contract or contracts; Routes or service areas, e.g. to optimize deliveries; Internal orders to determine e.g. the level of service implementation and maintenance costs; I do not *know [If the answer is I DO NOT KNOW - give short explanation if the lack of information stems from the fact that the respondent does not have a thorough knowledge of the functioning of the whole system in the company?]*.
11. Is the company able to investigate or apply continuous analysis, which will allow it to specify the degree of decrease or increase in a given cost group and associate it with the increase or decrease in another cost group? *[Possible answers: Yes; No; I do not know; It's hard to say]*.
12. Can all your company's customers place orders through the web site? *[Yes; No; I do not know; You can choose an answer and a short comment]*.
13. Do your company's customers have a possibility to control the order through the Web page (preview)? *[Yes; No; I do not know; You can choose an answer and briefly comment on - for example, whether such a possibility will exist in the future]*.
14. Can the recipients control the phases of completing the contract through the web site*? [Yes; No; I do not know; You can choose an answer and briefly comment on - for example, whether such a possibility will exist in the future]*.
15. Does your company use EDI standards (e.g. based on ANSI) in the exchange of information between suppliers and customers *[Yes; No; I do not know; You can choose an answer and briefly comment on - for example, whether such a possibility will exist in the future. If the answer is "yes" please give examples of types of standards]*.
16. What kind of software (in what areas) do you use today? It is possible to provide some answers. *[i.e. CRM, DRP / MRP, ERP; In the field of Ecologistics; Mans of transport entry and exit control; Logistics controlling; Reverse logistics; Optimization of logistics costs; Planning and optimization of loading; Route planning and shipments scheduling; RFID; Simulations and forecasting; Wireless technology (including mobile),*

TMS; WMS; E-business support; Security management; Product lifecycle management; International trade management; Demand management; Supplier relationship management, Order management; Inventory management; Integrated package of supply chain management support; Other - what?].
17. Which of software groups (see the explanation in the previous question), if it is not used today, would it be necessary to use in about 3-5 years?
18. Were any changes to the IT system implemented within the last 2 -3 years? If so, please shortly describe their cause and what area they referred to? Does the company intend to introduce some changes in the computer system within next 2-3 years? What are they likely to affect, what are they resulting from?
19. What is the importance, on a scale from 1 (lowest rating) to 7 (highest rating), of the exchange of information in the event of *[Enter in the column next to the endorsements: Planning operations in the logistics system; Emergency situations prevention; Decision-making by top management within 1 year or longer time span]*.
20. Please express your opinion to the statements in Table 1.

INDICATE ANSWERS "X"	Strongly disagree	Disagree	I don't know	Agree	Strongly agree
	1	**2**	**3**	**4**	**5**
Today, customers are more interested in a particular logistics service provider than the service provider is interested in a particular customer					
Your company performs much better the logistic functions than a) the answer for logistics service providers (transport companies, warehouses, etc.): other service providers; b) the answer for the manufacturing or trading companies: logistics provider					
Logistics service providers operating in Poland offer the same level of services as in other European countries and all over the world					
The level of logistics service offered by your company can still be improved with relatively low expenditure on IT system					
Our company has very good computer system fully used in cooperation with other companies					

21. Do you think that more important are such factors as: a) company image, price elasticity for services rendered or products sold, the competence of people in contact with the client and executing sales, implementing in the company customer suggestions; b) service accuracy, speed and flexibility in operation, developing information systems, exchange of information in real time between suppliers and customers *[You can indicate point a or b but also to express your (short) opinion in addition to your choice]* IMPRINT: – Is your company one of the following:
• a small business, • medium-sized enterprise, • a large company. – Does the company operate: • in Poland only, • in Poland and in Europe, • around the world (global). – Is your company the following type of operator:
• 2PL, • 3PL, • 4PL, • I do not know, • Difficult to say, • Customer logistics operators. – What voivodship in Poland is the registered office of the company? If this is a network enterprise, with several plants and / or branches, please indicate the location of the Head Office and branch of the respondent (in the indicated order).

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OPERATING MODEL OF A 4PL PROVIDER

Introduction

Currently the number of 4PL providers is increasing on the market for logistics service operators. This seems to be a natural consequence of processes associated with the progressive trend to reduce costs. Consequently, large entities, managing their logistics chains, also decide to outsource operations related to the integration of these chains, passing their expertise in this field to outside 4PL logistics providers. In Europe, a turning point of this process was the last decade of the last century, and the automobile industry was the industry in which these phenomena were initiated. Stronger companies tend to switch sources of supply to Asia, Africa, and South America emerged in those years. The construction of logistics chains became extended and more complex as a result of supply sources relocation. In these transformed and extended chains there was a need for deeper integration of both the physical flow and the regulatory sphere.

The logistics costs reduction has become an overriding aim. It happened that the complex logistics chain management has not been in the company's core business, what should integrate such a chain. Therefore, the companies have increasingly begun to seek specialized entities dealing with supply chain management – 4PL providers.

Analysis of the literature sources made by the author allowed the assertions that does not exist any universal model of 4PL provider. Most of the authors is limited, because to define the scope of activities offered by such an operator. Therefore the aim of science – both cognitive and application of this publication is to develop and provide the operator model of 4PL. This model should also be practical, defining solution for direct application in practice.

1. The evolution of 4PL providers

The number of 4PL providers has been increasing in the market for logistics service providers recently. This seems a natural consequence of processes associated with the progressive tend to reduce costs. Consequently, large operators, managing their logistics chains, also decide to outsource the functions related to the integration of these chains, giving their powers in this regard to 4PL logistics providers.

Analyzing the literature, however, a kind of duality in identifying the operating model of a 4PL logistics provider can be observed. Some authors claim that the 4PL provider is a virtual operator, whose main task is to integrate the supply chain of the ordering party (See: Mukhopadhyay, Setaputra, 2006; Jeszka, 2007;

Logistik für die Bundeswehr, 2011). Therefore, these authors most often assume that the primary resource for the 4PL provider is an information system functioning at the scale of the supply chain often supported by IT applications. The 4PL provider can perform its statutory activities thanks to it.

There is also an alternative path of the 4PL provider development indicated by such authors as M. Maternowska (2002), A. Zukerman (2009, pp. 24-28), J. Screeton (2009, pp. 30-34) or T. Komicz (2004, p. 10). According to them, the creation of a 4PL logistics provider is a natural consequence of the diversification and evolution process of the services provided by 3PL logistics providers. This can proceed in two ways: First as a natural evolution[*] of 3PL logistics provider, second as a rapid change in the scope of services offered.

The first of the mentioned cases occurs when the 2PL provider changes into the 3PL provider and the later eventually evolves into the 4PL provider[**]. The primary reason for this evolution is the need to adapt company's offers to the changing market expectations. These types of entities often start their business operations as transport companies. However, the shrinking gap between revenues and costs of their operations makes them to begin a gradual diversification of their activities. The natural development of the services portfolio is then:

1. The beginning of rending forwarding services, namely the organization of the whole transport process, often using a means of transport belonging to third parties.
2. Extending the business offer by multi-modal transport services, it is often imposed by a client of such a company or by legislative conditions under which such a provider operates.

Another phase of the provider's evolution is to extend further its offered services package by the broadly understood storage. This extension is probably associated with the customers' expectations for their comprehensive support and a progressive outsourcing process in the market. Customers often expect higher efficiency from entities specializing in providing logistics services, in comparison to what they experience in the form of insourcing. The emergence of 3PL providers (called Three Party Logistics) resulted from these processes. The providers offering the services related to the handling of the logistics chain at some point will meet the demand for services related to the management of this chain. In this way they become leading entities in the use of such chains.

[*] Through evolution, in this case, the process should be understood as diversification of the service package offered by the logistics provider and not by the company as such. This means such situations in which 2PL and 4PL providers can work side by side and it does not mean that a 4PL provider is a "higher" (and hence more evolved) form of 2PL operation.

[**] This process may also be limited to the change of 3PL operator into 4PL operator.

It seems that the crucial period in this process were the 1990s and the industry in which these processes were initiated was the automotive industry. During this time there occurred, on the one hand, the expansion of West German companies into, so called, the Eastern Lands and building of new factories in them. On the other hand, a stronger tendency to switch sources of supply to the Far East* and Latin America** appeared in these years.

All those led to elongation and complexity of logistics chains. In such chains there is also a need for their much deeper integration, both in terms of physical movement, and above all, the flow of information as well as proper synchronization of flows in these chains. All these changes were aimed at reducing logistics costs. At the same time the complex administration of a logistics chain was not in the core business of automotive industry companies. That is why more and more often they started to look for specialized entities. Naturally, they turned to 3PL providers who had been supporting them so far, with the need for expanding their portfolio of services into services connected with logistics chain integration and management.

The above-described processes run a parallel evolution path for 3PL providers. The existing providers of this type, having analyzed the emerging market trends, concluded that the possibility of offering services related to the logistics chain integration would make their offer much more attractive in comparison to other competitors from logistics provider. As a result, they often made decisions to buy applications supporting the logistics operations. Initially, these were ERP and CRM systems. Applications actually supporting the supply chain operations came onto the market not until the first decade of the twenty-first century, partially they were dedicated to specific providers and built on their experiences and for the market segment supported by them (e.g. Automotive, FMCG, Pharmaceutical Industry).

The above-presented methods of 4PL provider's evolution obviously show that the 4PL providers group is not homogeneous. There can be clearly distinguished operators who do not have their own logistics infrastructure, they focus on the information integration primarily and outsource other services. This group is called, in the later part, the 4PL virtual provider, unlike the other group representatives who have the logistics infrastructure. But the latter is also not homogeneous. On the one hand, we deal here with providers with limited resources consisting of a truck fleet and a number of warehouses, and, on the other hand, in the group there are also global logistics operators such as UPS, CARGOFORTE or DHL.

* E.g. VAG group.
** E.g. FIAT.

In the subsequent part of the paper a model of 4PL provider is presented. Due to the characteristics of the market, the nature of the data and a limited number of 4PL logistics providers operating in Poland it has been decided to select a research method involving the case study analysis by the means of an in-depth interview and an acquisition of expert data.

2. Operating model of 4PL virtual provider. UltraLogistik case study*

As it has previously been mentioned, 4PL providers can be divided into virtual operators and those who have their own logistics infrastructure. UltraLogistik Company is an example of a virtual provider operating as a part of the global Unilever Group and using the infrastructure of the concern. Unilever is one of the largest producers of food, household and cosmetic products in the world. It has 365 manufacturing facilities located on 6 continents and employs 167 000 people in 100 countries worldwide. Unilever's brands are present in 180 countries.

In 2006, a separate organization called the Unilever Supply Chain Company AG (USCC) was singled out of Unilever, seated in Switzerland. USCC is responsible for managing the entire logistics chain, so it is accountable for the flow of raw materials needed for production and finished products in the distribution network. It is also in charge of purchasing raw materials for production, transport, and storage contracts, purchase of pallet and forklift trucks. The scope of USCC operations is global, which allows the company to use the economies of scale in contracting raw materials and logistics services. One of the objectives is to optimize the USCC contracting power and organization of the transport process for finished products, packaging materials, semi-finished products and raw materials.

USCC, just in Europe alone, handles about 2000 transportation lines between locations in Europe, the number of transfers (volume) amounts to about 180 000 loads, while the value of the movement is about 200 million euros.

The analysis of logistics chains conducted by USCC, pointed out that despite global operations Unilever cannot take advantage of the aforementioned benefits of the economies of scale. The contracted logistics services in various markets in different countries are not centralized and synchronized. As a consequence, Unilever often contracts the logistics services from the same operator or carrier with separate contracts concluded for individual markets.

* Own study based on internal materials Unilever.

As a result of analyses, a decision has been made on establishing an entity called UltraLogistik, whose objective was to integrate Unilever's supply chain and to reduce transportation costs and related charges for the company. Currently, UltraLogistik is USCC operating office, in which all transportation and delivery operations to distribution centers are coordinated. The company expects that as an outcome of the operations of a newly established 4PL provider the following benefits will primarily occur:

1. Ensuring continuity of transport operations through the classification of transport and freight forwarding companies.
2. Implementation of the tender results in the Transport Management System (TMS).
3. The conclusion of new trade agreements with new transport companies, logistic centers, and logistics operators.
4. The amendment of existing trade agreements for more favorable for Unilever.
5. Gathering market information (Market Intelligence) by a means of special RFI questionnaires.

Unilever also expects that the establishment of the 4PL provider will bring the possibility of negotiating a lower transport charges per pallet compared to the previous year and to the market prices (the benchmark will be provided by Cap Gemini). At the same time, the maximum total rates increase year on year has been planned by 5%. The cost reduction does not exhaust the expected consequent benefits of UltraLogistik launch. The company also anticipates:

1. The improvement of the customer service level – the selection of the most reliable transport companies, with sufficient fleets to maintain a very high loading parameters and delivery on time performance (maintaining in 2011 KPI On-Time-Collection and On-Time-Delivery at 96%).
2. The reduction of greenhouse gas emissions – with relation to the sustainable development policy Unilever committed to reduce carbon dioxide in transport by 25% by 2015. This is possible mainly by moving a significant volume to a more environmentally friendly means of transport like trains, barges and ferries. There is also a possibility of using other types of trailers, such as two-floor semi-trailers. The target for 2011 is to reduce CO2 emissions in comparison to the previous year by 5%.
3. The reduction of the supplier number by 30%. The aim is to generate additional savings by:
   a) the cutting bureaucracy – a smaller number of invoices, complaints, contact persons, etc.;
   b) increased levels of customer service – by eliminating providers from the KPI level below the absolute minimum and transfer of transport lines to the suppliers with high levels of customers and on time deliveries;

c) enabling the selected suppliers to develop together with Unilever – as Unilever has set itself the goal of doubling the value of the business until 2020, the same happens to the volume of the supported loads. Thanks to close and partnership cooperation with suppliers it will be possible to reduce transport costs in the long term (Porada, 2011).

As it has already been mentioned, UltraLogistik is a 4PL virtual provider. It does not have its own transport and storage base. Handling of physical flows is carried out by external parties, however, often owned by the parent company. Depending on the geographical positioning of suppliers and customers as well as the flow rate are selected suitable carriers and storage infrastructure. The subject of 4PL virtual provider operations is primarily the flow of information. So, the selection of appropriate applications to support this movement is very important. Therefore, UltraLogistik implemented a number of applications supporting the 4PL provider's operations. The most important of these include: Transportation Management System, Trade Extensions, MS Office and communication software.

Transportation Management System (TMS) – a transport management system introduced in order to coordinate transport as well as accelerate and automate the process of creating transport orders for Unilever. The system included both customers (factories, distribution centers, warehouses) and UltraLogistik itself and suppliers, namely the transport companies contracted for individual lines. Figure 1 shows the process of completing an order in UltraLogistik.

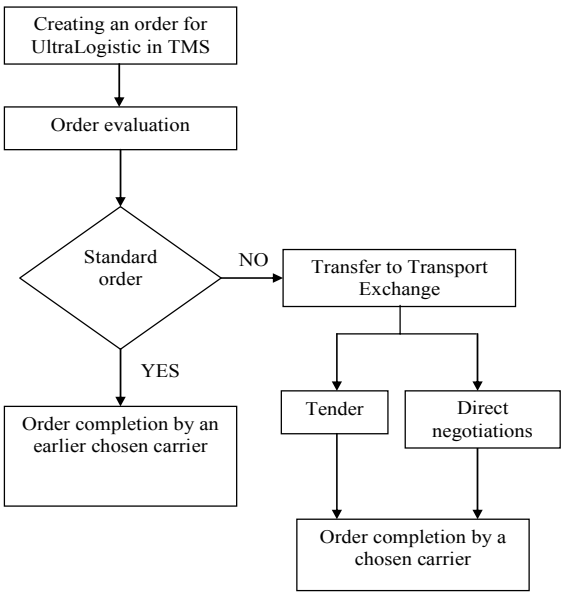

Figure 1. The process of completing an order in UltraLogistik

An order placed by a customer is sent in the TMS system to a transport specialist, who sees it, identifies the parameters for the so-called "Letter of Orders". Subsequently, the operator evaluates whether the order is standard or customised. UltraLogistik Company estimates that 90% of orders received are standard, and thus are assigned automatically to the contracted transport companies in the tender. After assigning to the transport company, appropriate information is sent to it. TMS sends it directly to the interface located at a transport company and as a PDF attachment to email messages in the mailbox of the carrier. On this basis, the carrier delivers the order.

The remaining 10% of orders are called non-standard cases. An example of such an order may be, among others: unusually bulky cargo, non-full pallet packaging, shipping samples to a new customer.

In this case, the order goes to the internal transport exchange and is a subject to an additional tender. A different approach is also applied in the case when there are other requirements for transportation than those defined in the tender (e.g. shorter delivery time, another type of movement, and others). In this situation, a relevant employee contacts a transport company and renegotiates the rate for transport. If negotiations prove to be not rewarding the order goes onto the transport exchange.

TMS is based on a dedicated database. This database supports the implementation of each tender. The data supplying this database are exported as a file or MS Excel file and then checked for correctness by the Regional Operational Teams that own the data. Subsequently, once verified, the data are imported into another application – Trade Extensions, which handles tenders. After the tender process data are re-downloaded to the Trade Extensions in the form of MS Excel file and sent to the finance department. Then following the verification of compliance by the Finance Manager they are passed to the TMS team in order to update the database.

Another application of supporting 4PL operations in UltraLogistik is Trade Extensions. This application supports the implementation of e-procurement tenders for transport services. The procurement process support is carried out on several grounds, namely: project support, procurement support, analyses support, information flow support. The support of projects in the field of transport: through the ability to define a range of parameters such as a phase of a project (work flow) it is possible to define the negotiating rounds, the planning phases and evaluation of data as well as assigning the deadlines for these phases and tasks. The platform also allows the company to create tasks for both project managers and suppliers or to support (RFI, RFQ, RFP, Contract Management).

Tenders support – thanks to the Trade Extensions application it is possible to organize "reverse" (lowest rate), and "forward" auctions (best offer). It is

possible to define complex formulas calculating rates in accordance with buyer's needs (for example, the total annual rate, taking into account the rate of exchange differences arising from the calculation in different types of currencies, types of equipment supplied and capabilities of servicing the assumed volume) in the application. This enables a complete control over a tender with a minimum commitment of operational staff.

Analyses support – Trade Extensions thanks to advanced algorithms allow for data comparison, in a very short time, creating complex scenarios and business models. Thanks to the extraordinary friendliness of the application it is possible, after completing a short training, to create queries and rules as well as to filter data. Consequently, the user receives an extremely efficient analytical tool. In case of UltraLogistik it is used for many purposes such as, among others: calculating tenser results, benchmarking results, the searching for optimal negotiating strategies.

An example of the analytical module use may be the creation of a "realistic" scenario, in which certain rules are defined, such as:

1. Time of a transit cannot be longer than the present time by 1 day.
2. Up to 60% of allocations on the lines can be changed (limited change management).
3. On ice lines, due to the seasonality, there must be 3 suppliers, etc.

After preparing the scenario, generating the results takes about 2 minutes. The system generates all possible solutions to the scenario and then presents the most cost-optimal solution. In addition, it compares the result to the historical data and shows the increase in costs or savings in the selected scenario. This allows the company to create quickly a number of scenarios and then compare the results and choose the most optimal approach for further negotiation or allocation of resources and transport. The system also allows for rapid generation of statements and reports with graphs.

Support the flow of information – the last but an extremely useful tool for Trade Extensions is an application with which it is possible to send messages with assigned tags. This permits the company to send direct messages from the platform to a very large group of recipients, with clearly defined terms of information. The use of the mail application is required to send them separately to each recipient individually.

Another of the applications which supports 4PL operations in UltraLogistik is Microsoft Office 2003. The basic tools used in this package are MS Excel and MS PowerPoint. MS Excel is an application used in UltraLogistik for converting, transferring and processing of data. Its main advantage is that it is compatible with other applications used in Unilever as well as the Transportation Management System (TMS) and Trade Extensions. All data from these two platforms can be

exported to Excel as a file type as well as imported back into this format. Thanks to which such data can be developed and presented in the form of charts and tables.

MS PowerPoint is used mainly for presentations, as well as to create training materials. In addition, to a small extent, MS Word is used to create technical documentation, contracts, orders and others. The documentation in MS Word is then converted to PDF format and sent to suppliers.

The last type of application used in Ultralogistik is communication software. The company uses two types of applications – Live Meeting and BT Teleconferences services. This software is used for communication between members of the team organizing the transport processes, located in different places in Europe. Through advanced teleconferencing services there are conducted both internal business meetings as well as severance and training for suppliers (such as training of the tender operating platform Trade Extensions).

Analyzing the operations of 4PL provider of UltraLogistik Company, it should be noted that this provider supports only one company. However, in contrast to the 1PL and 2PL providers, due to the scope and nature of performed operations, it should be classified as the 4PL provider.

UltraLogistik model of company's operations does not include the possibility of "deeper" service of its customers, including, for example, planning their production. It is evident in the lack of software such as ERP. In consequence it closes, at this point, the possibility of expansion in the market and offering services related to supply chain integration to other customers outside Unilever. On the other hand, the UltraLogistik operations model shows the basic mechanisms of 4PL provider operations and as such is an important basis for creating a general model of such a provider.

3. Practical model of 4PL provider*

By creating a practical model of 4PL operator adopted four basic assumptions**:

1. 4PL provider supports both physical and information flows.
2. 4PL provider should be open.
3. 4PL provider (or its division) should serve only a specific industry.
4. 4PL provider can have its own logistics infrastructure***.

* The operation of a 4PL model was developed based on expert knowledge of the author and his consultancy studies in this field for business operators who are 4PL providers.

** This model developed by the author's work is also consistent with the model presented by M. Christopher (2005, p. 296).

*** Many authors point to the virtual nature of the 4PL service provider however, according to the author's study should have a 4PL provider also own logistics infrastructure. This reduces costs, increases flexibility, reduces risk. and is also indicated in some industries due to the specific conditions of storage and transport materials (eg. branch petrochemical, pharmaceutical, and FMCG).

The 4PL provider should handle both the realm of physical as well as regulators flows. This assumption eliminates companies that offer services related to supply chain information integration, or even offer services related to the provision of on-line applications supporting the operations of such a chain. The 4PL provider should not be limited to handling only one company, but also offer its services outside of its logistics chains.

The third assumption is also important. It follows from the fact that each industry has specific conditions as well as technical and legislation requirements[*]. Therefore, the provider should specialize in serving selected industry[**]. Specialization is also due to the fact that the provider integrating the supply chain should also select suppliers of materials and services in accordance with the priorities relevant to given industry. Consequently, it should have an accurate diagnosis of the market (markets) and the exact knowledge of the suppliers.

The last of the assumptions is related to the previously mentioned three assumptions. It is not mandatory, because as the example of UltraLogistik shows, the 4PL provider can offer its services using external logistics infrastructure. However, some industries require adequate expertise and technical equipment[***]. Thus, the acquisition of logistics service providers satisfying expectations in this respect is impossible in some markets. Therefore, the 4PL provider supporting such an industry should also have the necessary logistic infrastructure[****].

The 4PL provider integrating supply chain combines the information flow and physical flow. UltraLogistik example shows that the integration of the regulatory sphere should be carried out using a wide variety of applications. The basic components are:

1. SCM (Supply Chain Management) software.
2. Project management supportive software.
3. Software supporting the creation and flow of documents.
4. Communication software.

The aim of SCM software is to ensure the flow of information between supply chain links as well as processing and sharing of data in the form of repor-

[*] For example, food industry requires infrastructure to maintain the "cooling chain", registration of storage and transport conditions, and the whole set of rules relating to traceability, which other industries do not have. These elements dictate the logistics provider specific technical solutions that cannot be transposable to other industries.

[**] Certainly, situations when we are dealing with a global operator such as UPS or DHL are assumed for, whose divisions specialize in servicing particular industry.

[***] For example, the pharmaceutical industry.

[****] The industry companies when choosing a provider often place the requirements for it to have its own storage and transport facilities. This is to ensure adequate customer service in the case of JIT delivery.

ts on all events occurring in the supply chain. Figure 2 shows the basic functionality of such software.

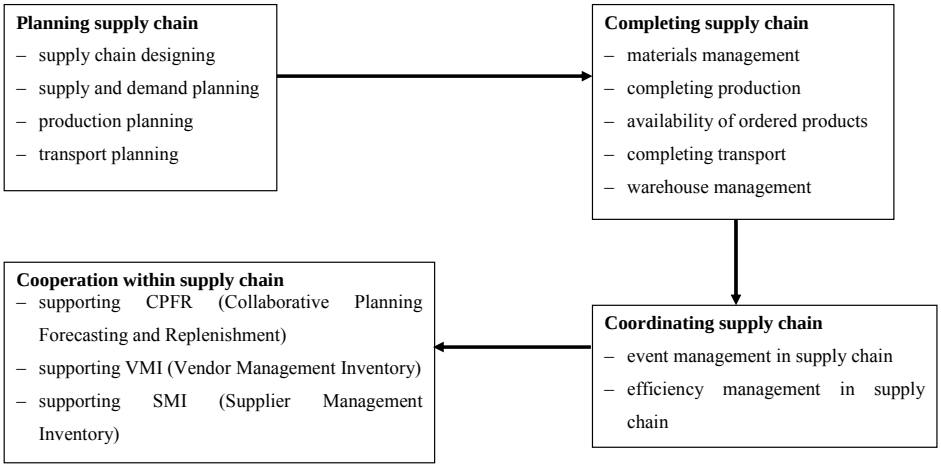

Figure 2. Basic functional performance of SCM

Source: (Żabicki, 2011).

Analyzing the content of Figure 2 and UltraLogistik case, the basic software modules supporting operations of the 4PL provider can be specified:

1. ERP Module with support for multiple locations for planning and coordinating production in logistics chain entities.
2. Transport Module, used to support and optimize the transport orders and freight rates.
3. Storage Module (WMS) can support multiple locations to manage the material in storage, acceptance and download the material.
4. QM Module for recording of deliveries quality.
5. Controlling Module.
6. Financial-Accounting Module (FA).
7. e-procurement Module, supporting e-procurement.
8. Module supporting the project management.
9. Communication Module allowing a company to conduct teleconferences and sending e-mails to the prepared list.
10. The data warehouse integrates information obtained from all participants in the supply chain.

The application packages listed above can operate as an integrated software as well as a separate application. However, the condition that should be always maintained is the ability of direct data migration between these applications.

This eliminates situations in which this transfer of data from one platform to the other requires middleware such as spreadsheet.

The number of modules and their kind are dependent on the type of relationship with the 4PL principal provider. As in the previously described Ultra-Logistik case, the operator integrates one company supply chain, so it uses the following applications: ERP, Controlling, FA, and other Unilever company. In the situation, however, when the 4PL provider supports external customers, and they are several, it should have all of the above applications. Since this allows it for the integration of logistics chain and coordination of all operations in real time as well as planning, implementation and monitoring at the operational level. Figure 3 shows the flow of information monitored by the 4PL provider.

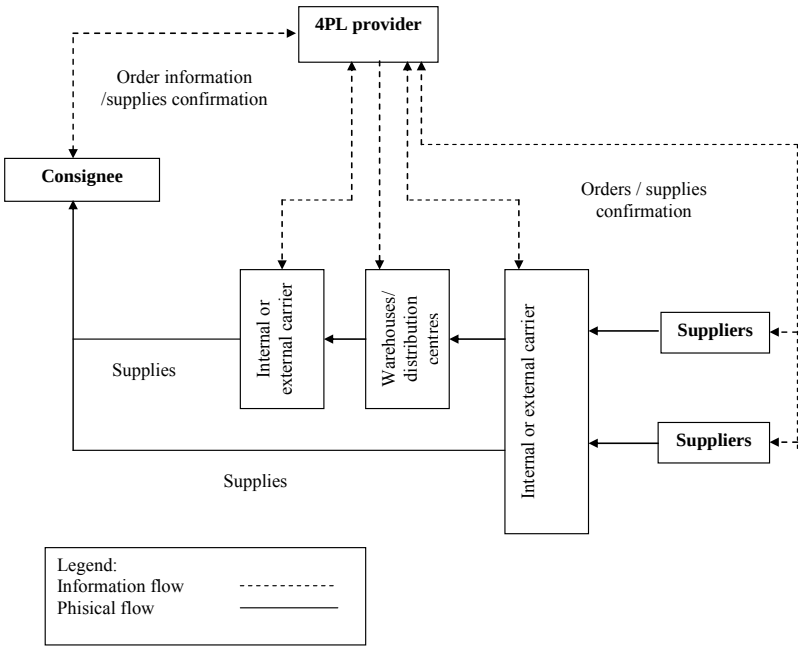

Figure 3. The information flow integrated by 4PL provider in the logistics chain

A contractor by issuing an order in the logistics chain communicates only with the 4PL provider (Figure 3). The latter is responsible for coordinating further operations by other participants of the supply chain (suppliers, carriers, etc.). In practice, such coordination may even include production scheduling and queuing of orders for the production of suppliers on behalf of the consignee*. All these operations are carried out by the 4PL provider.

* Such services are offered by DHL, using SAP R3 software.

Support of the logistics chain regulatory field does not exhaust the scope of operations pursued by the 4PL provider, as it operates in the sphere of physical flows. The integration of the logistics chain by the 4PL provider requires completing four basic processes: the qualifications of materials and services suppliers, supply, raw materials and finished products stock maintenance, organization and delivery to customers*.

The first of these processes involves the search, selection and qualification of materials and services suppliers. This process continues throughout the period of collaboration with potential customers and leads to creating a database of qualified suppliers**. The 4PL provider should first define the logistics chain***. On this basis, in the agreement with the contractor, the 4PL provider looks for suppliers and subcontractors. They are selected for a defined order in the manner set out further. Subsequently, after the selection of suppliers, pursued by running the following processes. In the adopted model a complete flexibility of operation has been assumed, as a further order may lead to a reconfiguration of the suppliers' structure so as to ensure optimum delivery cost in units approved by the contractor, and under the assumed security of supply.

Another of the mentioned processes in the logistics chain integration is the supply process. Figure 4 shows the components of this process.

* This problem has been widely addressed in Shary, Skjott-Larsen (2002, pp. 147-150).

** Qualification of suppliers affects not only the supply of raw materials or supplies but also services supplies such as storage and transport. As a result, a database is created that can be used to meet the needs of multiple contractors.

*** This means creating a model using the resources of the client and defining changes in the existing supply chain and identifying the resources needed to implement such a model. This is consistent with the concept presented by K. Rutkowski (2000, p. 32).

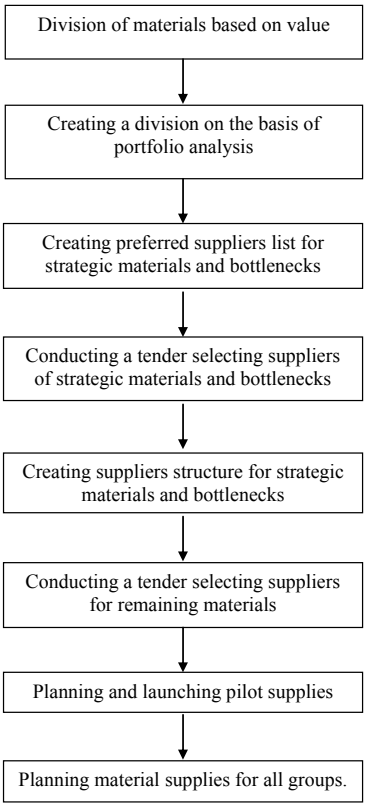

Figure 4. Algorithm of supply process

Source: Own study based on: (Kasperek, Świerczek, 2010, p. 32).

The first stage is an appropriate allocation of purchased materials. This division should be performed in two successive steps:

1. Separation by the ABC method, due to the value of the three basic groups. This is necessary for the next step of analysis.
2. Conducting a portfolio analysis in the field of purchases based on two basic parameters – the value of purchased materials and the risk of a supply (Based on: Kasperek, Świerczek, 2010, p. 32).

This division is necessary in order to diversify the selection and cooperation policy with suppliers in the supply chain. Strategic materials and bottlenecks, due to the value and risks of supply, are supported by preferred suppliers. Such a list is created on the basis of a qualified suppliers list. Preferred suppliers are qualified providers complying with additional parameters not related to the evaluation of the quality of their rendered services (such as a distance from the contractor, experience in co-operation). The list of preferred suppliers is maintained

by the 4PL provider, and it organizes, in order to select the best one, tenders for the internal most optimal supplier. A tool supporting the selection of suppliers is the tendering platform vendors – Figure 5.

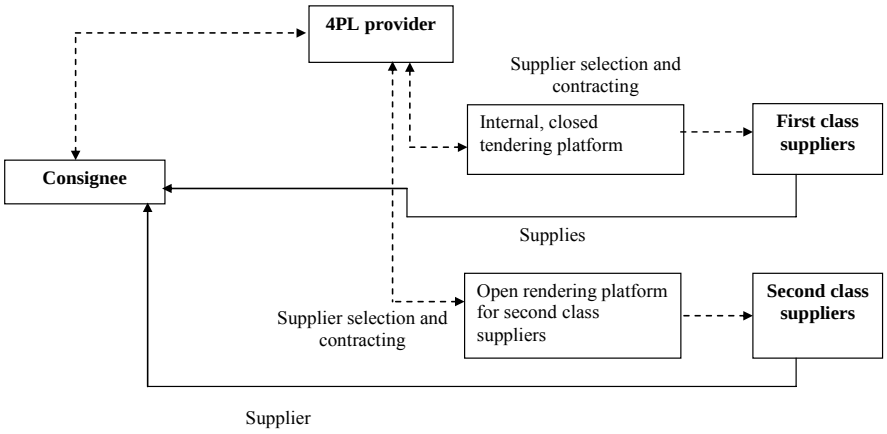

Figure 5. Schematic of supply contracts

Source: Own study.

This type of a solution providers, on the one hand, considerable flexibility in selecting suppliers and negotiating with them the optimal conditions of trade, on the other hand it has, a serious limitation. The 4PL provider, as it has already been mentioned, can operate in one industry only or in a limited number of industries. This requirement is related to the creation of an adequate structure of suppliers and then their continuous assessment.

Subsequently, via e-procurement platform, the most optimal choice of suppliers is made. A key element here is not only price, but also the flexibility of supply and a minimum lot size of a delivery.

Due to the fact that the 4PL provider coordinates physical movement, it controls both the quality of supplied materials and any damage in transport and other logistical parameters. Consequently, as mentioned earlier, it takes over from its suppliers formal tasks related to certification and subsequent evaluation of strategic suppliers and bottlenecks.

For materials from the leverage and routine groups the selection of suppliers is carried out based on an open tendering platform. Due to the fact that the materials bought in this way have a relatively low value, they are non-critical and highly substitutable, the choice of suppliers is not a subject to such rigors rules as in the case of the suppliers for strategic and bottlenecks materials. Using a tendering platform, usually one or two suppliers are selected. The deliveries

are monitored and evaluated on similar basis as described above. Using similar mechanisms, as in the case of supplies of strategic materials and bottlenecks type, the 4PL provider continuously assesses suppliers and quality of materials supplied by them. Within time, along with the collection of data on the suppliers participating in the supply of materials and services in a variety of logistics chains supported by the 4PL provider, a list of qualified suppliers is created who reliably perform their deliveries. This allows a company to increase security of supply and reduce costs associated with the qualification of suppliers, because the experience gained from work with one supplier can be used in many supported logistics chains.

Closing the stage of suppliers selection, opens the next stage of organizing the pilot supply. These supplies are the control amounts, subject to special supervision by the 4PL provider and the contractor. These types of operations increase the supply security and also eliminate the risk, occurring particularly at the start of deliveries from a new supplier and the associated decline in the quality during the first few deliveries.

At this stage, the 4PL provider plans the supplies volume and delivery time as well as controls more intensively, along with the client, technical quality and other parameters of logistic supply. In a situation where the contractor does not have the appropriate control instrumentation, the 4PL provider can arrange services of control studies, quality, outsourcing them from an external unit. When contracting many orders of this type the 4PL provider can effectively negotiate a low price, compared to the price the contractor would have to bear, while maintaining the necessary laboratory controlling the quality of supplies. The pilot phase closure of the supply is equivalent to starting an adequate supply of 4PL provider. At this stage, its role is to coordinate the physical movement of material from suppliers to customers and also to support the flow of information.

Another process to be executed by the 4PL provider is to maintain inventory. In the logistics chain inventory is a protective buffer against the individual links of different risk factors. The 4PL provider integrating the supply chain in order to optimize inventory can allocate inventory in the right places and amounts in the logistics chain, virtualize inventory or/and organize emergency supply[*].

The 4PL provider having forecasts and sales plans as well as current information on stock sales can allocate inventories to the most appropriate places in quantities corresponding to actual demand. Thanks to this it is able to reduce the global level of inventory in the logistics chain and to adjust its structure to the actual demand.

[*] This is in accordance with the concept presented by M. Christopher et al. (2009).

Accurate expertise in the characteristics of processes associated with the supply organization of raw materials as well as goods and products allows the 4PL provider to virtualize inventories (See: Caridi, Cigolini, 2002, pp. 556-576; more broadly on the topic: Chi Chu et al., 2004, p. 131; Tetteh, 2009; Clark, 1998, pp. 486-507; Crowley, 1998, pp. 547-574; Bal et al., 1999, pp. 71-82; Hakansson et al., 1999, pp. 443-452; Antia, Frazier, 2001, pp. 67-81). As a result, information about the stock replaces the actual inventory. The role of the logistics provider is reduced, therefore, to ensuring the availability of inventory, by optimizing decisions on the physical transfer of materials and products from the places of their allocations, and in places where there is demand for them. This eliminates the stock held in multiple locations, limiting it to the selected by the 4PL provider places and ensuring the availability of information on places of storage.

The control of physical flows in the logistics chain also allows the 4PL provider to mitigate or eliminate distortions in flows of materials and products. Due to the aforementioned limitation in the level of inventory in the chain the 4PL provider uses the so-called "emergency deliveries"*. Coordinating the operations related to transportation, it should also contract out such carriers who would hold resources (transport fleet), necessary for the implementation of such supplies. In a situation where there is a delay of delivery, and which in consequence can lead to a delay or hold-up of earlier established plans for the production or supply, the 4PL provider starts the emergency delivery, offsetting this threat. In summary, the 4PL provider by means of a complex service of the entire supply chain can effectively reduce the level of inventory throughout the chain, while reducing the risks associated with the lack of supply or defective supply.

The last of these processes is the delivery to customers. This process is a natural consequence of the qualification process of suppliers and subcontractors and supply. The 4PL provider, building the transport companies structure relays on the list of qualified suppliers and the previously described principles. The structure of the distribution network is usually taken from the contractor. However, it is reconfigured by the 4PL provider. This reconfiguration usually refers to the location and number of warehouses and distribution centers and is a natural consequence of optimizing the allocation of inventory and warehouse base that is owned by 4PL provider. Figure 6 shows a model of 4PL provider in the field of distribution.

* Emergency deliveries are supplies completed with a fast means of transport such as aircraft, in order to compensate supply disruptions. However, the use of such means of transport rapidly increases transport costs.

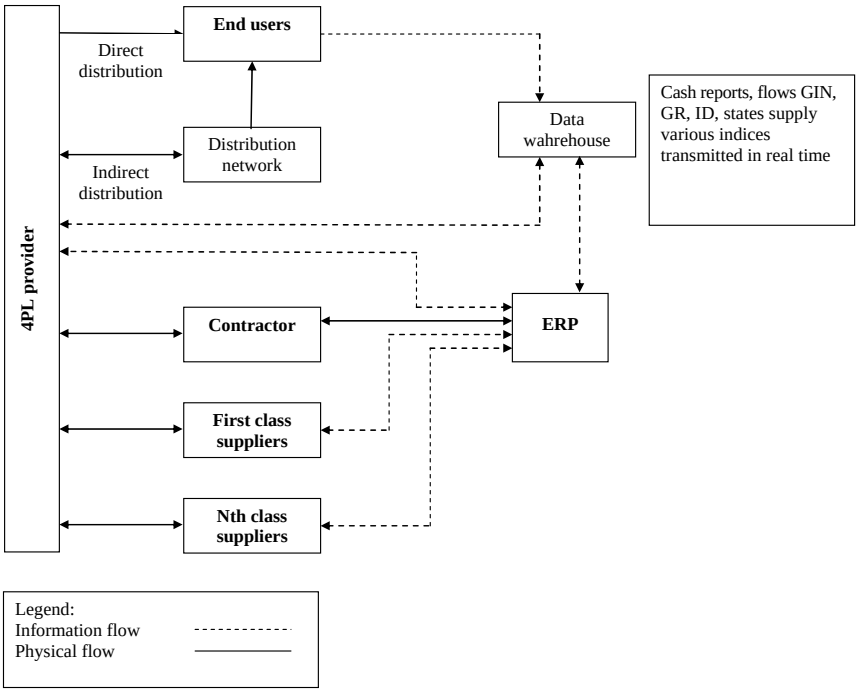

Figure 6. Distribution coordination by the 4PL provider

Source: Own study.

The primary tool for the logistics chain information integration on the distribution part is the data warehouse and ERP software. The task of data warehouse within the frame of the information support of distribution processes is:

1. Acquisition, aggregation, and further transfer of information from cash reports of the distribution network.
2. Identification of the inventory level at each level of the distribution network.
3. Identification of the events connected with the distribution, conducted in real time, and involving the aggregation and sharing of documents such as, among others: RW(Internal outgoings), PZ (Receipt of Goods at Warehouse), MM (Inter-Warehouse Transfer).
4. Communication with the ERP.

Acquisition, aggregation, and further transfer of data from cash reports, is essential for planning the supply of materials, maintaining inventories and deliveries of products from the contractor to the distribution network. Thanks to cash reports the 4PL provider is able to track independent demand and well in advance to plan delivery of materials to the contractor. In many cases this lead-time is longer than the contract duration. Consequently, the 4PL provider can

accurately predict the demand of the distribution network, prepare for it satisfying it directly from the production or completed inventory, and thus significantly reducing the level of inventory held.

If the 4PL provider has information on demand and, through a data warehouse, information about current inventory level and all related with it orders, it may actively use the distribution requirements planning – DRP. In practice this means:

1. Appropriate selection of transport means for cargo, transport time and the distance between the individual links of the logistics chain.
2. Proper allocation of adequate quantity, the right product at the right link of the distribution network, taking account of local demand, existing inventory supply and to provide the maximum level of customer service at minimal cost.
3. Handling of returns and complaints between the individual links of the logistics chain.
4. Servicing of the so-called "reverse logistics" and recycling associated with the transport and storage of waste resulting from manufacturing processes or transport and stored inventory damage.
5. Servicing the packages turnover between the individual links of the logistics chain, and their acquisition, storage, contingent maintenance, and replacement.

The above-presented model of the 4PL provider operations is based on the analysis of the described UltraLogistik case and DHL, Apreo Logistics companies. It assumes that the 4PL provider performs essentially its operations in the regulatory sphere of logistics chain. However, its operations should not be, as it has already been mentioned, limited to the scope of its activities to this particular sphere only. The examples of DHL or Cargoforte show that the 4PL provider may also have its own fleet and logistics infrastructure. In such a case, apart from an outside supervision of the information flow and supply chain integration, it performs a number of operations of a strategic, tactical and operational character connected with the development, maintenance and use of this infrastructure. The nature of these operations, however, does not differ from the scope of activities undertaken in this field by 1PL, 2PL, 3PL providers.

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A CONCEPT OF MODELS FOR SUPPLY CHAIN SPECULATIVE RISK ANALYSIS AND MANAGEMENT

Introduction

There is a growing need for better understanding and handling of risk among decision-makers managing organizations cooperating in contemporary supply chains. The number of risks and their impact is growing, as supply chain members are becoming more and more interdependent, and their business environment is a source of many challenging situations. When it comes to risk analysis and management in the context of supply chain, it is worth to recognize which risk can bring negative or positive effect for a supply chain. In other words, successful risk analysis and management should consider its speculative nature. Due to a lack of concepts useful to analyse and manage speculative supply chain risk, the aim of this paper is to suggest a proper framework for such processes based on the literature review.

1. Defining supply chain speculative risk

Because of a significant growth of modern supply chain vulnerability, there is an increasing need to highlight the importance of risk analysis and recognize the methods of managing it. In the context of this paper, it is very important to distinguish between the terms such as certainty, uncertainty and risk, and consequently between pure and speculative risk. Certainty means simply a lack of doubts, while its antonym, uncertainty, can be defined as doubting in the ability of anticipating the effects of present activities. Finally, risk can be generally defined as potential event's variability of known probability and impact. Therefore, the fundamental difference between uncertainty and risk is the possibility to measure the latter. Consequently, we can manage risk, while the idea of managing uncertainty seems to be completely unrealistic (Williams, Smith, and Young, 2002).

Undoubtedly, uncertainty is a very important issue in contemporary supply chains. Uncertainty – which is always a negative phenomenon – causes the ineffectiveness of processes, which, in effect, do not add the desired value. Moreover, uncertainty results in waste, because it forces the supply chain decision-makers to generate bigger safety buffers or greater capacity to prevent disturbances in the processes managed by them. Such protection constrains operational performance and suspends the competitive advantage of a single firm participating in a supply chain, or of the supply chain as a whole (Vorst, Beulens, 2001). J.G. A.J. Van der Vorst and A.J.M. Beulens (2001, p. 412) suggest to define **supply chain uncertainty** as follows: „Supply chain uncertainty refers to decision making situations in the supply chain in which the decision maker does not

know definitely what to decide as he is indistinct about the objectives; lacks information about (or understanding of) the supply chain or its environment; lacks information processing capacities; is unable to accurately predict the impact of possible control actions on supply chain behaviour; or lacks effective control actions (noncontrollability)".

On the other hand, **risk,** understood as a measurable uncertainty, may be described (Andersson, Norrman, 2003, p. 380) as:
„(…) a quality that reflects both the range of possible outcomes and the distribution of respective probabilities for each of the outcomes, it can be calculated by following general formula:

Risk = Probability (of the event) x Business impact (of the event)

This kind of uncertainty may be considered on different levels and from the perspective of different human activities (Krupa, 2002):

1. On the **information level** there can be distinguished:
   - full information state (certainty area),
   - satisfactory information state (risk area),
   - incomplete information state (uncertainty area).
2. On the **functional level** risk can be distinguished in areas such as:
   - research and development,
   - logistics,
   - finance and controlling,
   - production,
   - marketing,
   - administration.
3. On the **symmetric level** risk can be considered as a threat, which means that from the decision-maker perspective taking risk can only bring loss (**pure risk**) and as a threat and an opportunity as well (**speculative risk**). Hence, speculative risk is included in undertakings and activities which can bring profit as well as loss. It may be stated that this kind of risk is a business driving force – businessmen sometimes say "No risk, no profit".

Continuously, speculative risk is included in supply chain activities (e.g. a decision to use outsourcing can bring many benefits for the whole supply chain, while causing significant disturbances at the same time). For the purpose of this paper, the author suggests to define **supply chain speculative risk** as a possibility of obtaining negative or positive consequences of future events occurring within the supply chain or its environment, of known probability and impact.

2. Nature, role, and implementing guidelines of risk management

D. Borge (2001) implies that a decision-maker has to act according to his or her beliefs. Even if he or she does not have enough information about the potential effects of his/her activity, a decision has to be made. This is because even not doing anything is a kind of activity. The decision to remain passive brings certain consequences, just like any other decision. Not doing anything can mean a loss of valuable opportunities or enabling potential threats to become reality. However, idleness can also mean that potential options have not been used yet, because the decision-maker is waiting for new information. Regardless of what decision will be made, the action is always based on some kind of belief about its potential effects, even if that probability is determined in a subjective manner.

P. Drucker (1976), a classic author writing about management sciences, states that managers tend to assume that nothing can be done in order to change the situation. Relatively common are attitudes which can be summarized by the following sentence: 'If we knew how to overcome constraints of a given process, we would do that'. Indeed, such process can be difficult to change, but saying that it is impossible to improve it is certainly not true. The author encourages decision-makers in organizations to act, because in his opinion:

- threats and constraints of a given situation are usually well-known or can be easily recognized;
- every crucial change proposed, which aims to overcome threats, is perceived by members of given organizations as unlikely or even impossible, but it is often coming at the right moment;
- every time a serious threat or constraint can be transformed into an opportunity, the economic effects of such transformation are usually significant – that means that such a threat/constraint can be regarded as an important opportunity; overcoming such threat/constraint almost always requires a systematic search of innovations, i.e., in short, a continuous analysis to determine the requirements of new capacity (production or service), or new information and systematic efforts to develop those innovations (Drucker 1976).

On the one hand, decision-makers are becoming aware that their protective or even passive attitudes against risk will not solve the problems they are facing and can make their situation even worse. On the other hand, in today's economy the number of risks and their impact on organizations is increasing. As a result, risk management is gaining growing importance in many different areas of human activity – insurance, finances, managing different organizations (as single entities or as parts of supply chains), design, politics, research & development, etc.

According to P. Sienkiewicz (1994), the beginning of risk management concept has to be traced back to 1920s, when the so-called risikopolitik was developed in Germany, and 1930s, when American insurance companies started to implement risk management practices. The main aim of German risikopolitik was to secure different types of business against the effects of uncontrollable inflation and, in consequence, to make them able to survive. T.T. Kaczmarek (2005) remarks that risk management played a historical part in many 20th century events important from the economical, political, scientific and technological points of view. Wars have to be mentioned in particular, namely, among others, the Russian-Japanese war, the First and Second World Wars, the Korean War and dozens of local conflicts on different continents. Many other important events have to be mentioned as well: the production of the very first car, the invention of television set and computer, the big economic crisis in 1930s, the rise and fall of totalitarian systems (fascism and communism), the invention and production of atomic bomb, the construction of nuclear power stations, the rise of environmental dangers and global warming. The above list can be supplemented with other events, such as the sinking of Titanic, the ecological disaster in the chemical factory in Serveso (Italy), the explosion of a nuclear reactor in Chernobyl (Ukraine), the Challenger catastrophe (USA), the hijacking of Exxon Valdes ship, the terrorist attacks in New York on September 11th. Last but not least, natural phenomena in different regions of the world, such as earthquakes, hurricanes, tornados and cyclones, have to be taken into consideration. All of these situations stimulated the development of a new multidisciplinary field encompassing management and economic sciences, i.e. risk management.

Risk management is also an object of growing interest in the supply chain management area. In 2002 "The Economist" conducted a survey to obtain full understanding of the new supply chain management concept's influence on executives working in international companies (Spekman, Davis, 2004). More than 65% of them declared that their organizations are now and will be even more dependent on the relationships they develop with different external organizations in order to accomplish their business goals. In their opinion, the most important features to be considered when choosing a vendor or service provider are the following: high level of expertise, reputation and excellent recognition of customer needs and requirements. At the same time more than 65% of respondents expressed their fears that such strong interdependencies between their organizations and business partners can lead to a loss of control and higher vulnerability. Therefore, on the one hand the popularization of the supply chain management concept can bring significant benefits to the organizations, however, on the other hand it increases the interdependence of supply chain members, as they intensify

their efforts to improve efficiency and effectiveness. The research conducted by "The Economist" confirms once again a growing need to supplement the supply chain management concept with the risk management factor.

There is a number of reasons for the increase of the importance of risk management in contemporary organizations. Among others, it should be mentioned that (Sadgrove, 1996):

- Law regulations are becoming more complicated, their number is growing (e.g. intensive E.U. legislation activity can be observed), and they are much more restrictive.
- Insurance policies are much more expensive and difficult to obtain. Moreover, insurance companies more frequently demand proactive risk management from their customers. In addition, it has to be noticed that insurance payments often do not fully cover losses and that the process of pursuing an insurance claim is long-lasting. Finally, not every asset can be insured (e.g. lack of reputation) and insurance itself does not prevent the occurrence of loss.
- Business clients more often than before try to transfer the responsibility for losses to their suppliers and are more demanding with reference to the supplied goods and services. The shareholders of customer organizations are also much more often interested in their suppliers' vulnerability, because they are aware that as a result of today's growing interdependencies between companies' (e.g. through implementation of the supply chain management concept), the risk impacting their suppliers can also have an indirect influence upon them.
- Today societies are more critical against business activity and their expectations regarding companies' attitudes towards ecology or product safety issues are increasing.
- Managers working in contemporary companies have already obtained sufficient expertise collected as a result of previous experiences of other companies in the area of risk handling and they are fully aware of the importance of risk management. Also employees demonstrate an increasing level of specialization and professional skills, and the scope and complexity of today's managers' tasks and objectives is growing because of globalization.

The review of risk management definitions presented below is oriented on the enterprise management, because this is the context relatively closest to the supply chain management area. Among others, the following examples of definitions can be cited:

- A bundle of activities and tools achievable for a company, which enable to reduce the impact of risk on company's activity and performance and to ma-

ke optimal decisions aimed to reduce risk. Precise recognition of risk nature and impact allows to choose right activities preventing its negative effects in a right time (Michalski, 2004).

- Searching and taking actions which should secure the decision-maker against losses higher than those acceptable according to the adopted security level (Krupa, 2002).
- Set of mathematical-statistical and heuristic methods aimed to make optimal decisions about right activities, as well as means and ways of achieving the established goals of the enterprise (Penc, 1997).
- Set of activities aimed to determine the right way of risk handling (*Leksykon zarządzania*, 2004).
- The ability to handle the risk (Chong, Brown, 2001).

It can be clearly concluded that the first two definitions emphasize the negative nature of risk (risk as a danger), and the rest of them assume that it is a neutral phenomenon. In other words, they are not sufficient to manage speculative risk (which can bring loss and/or benefit). M. Krupa (2002, p. 40) is one of the authors who propose the approach towards risk management oriented on its speculative nature. In his opinion **(speculative) risk management** is „(…) a set of activities connected with planning, organizing, motivating and controlling of personnel, as well as material and information means connected with business activities, which are characterized by probability of resulting success and/or failure (profit and/or loss)".

D. Borge (2001) presents a similar opinion when claiming that risk management means taking rationale, well thought actions to use opportunities by enlarging the possibility of achieving beneficial results and reducing the possibility of achieving negative results. Also T.T. Kaczmarek (2005) states that enterprise development is connected with threats as well as opportunities, and thus the main aim of risk management is to identify both threats and opportunities. Finally, F. Wharton (1992) claims that risk management should not be focused only on pure risk. Thus, rational risk management approach should be based on **three cardinal rules**:

- maximizing expected opportunities,
- avoiding threats,
- ignoring less probable possibilities.

The approach implied by the above-mentioned authors should be popularized among decision-makers in today's organizations, because, as it has already been stated, situations perceived as threats (or constraints) can potentially bring great opportunities, if they are treated in a right manner. It should also be recognized that risk management:

- can have reactive or proactive orientation;
- should be treated as a continuous process in which all members of an organization are truly engaged and should be an internal part of the overall organization management process;
- needs the involvement of the whole organization to result in maximum effectiveness;
- is crucially important for the success of an organization functioning in today's business environment (Scarff, Carty, Charette, 1993).

The very first of the above-mentioned postulates needs some further explanation. In general, organizations can present one of two attitudes against risk and, as a result, adopt different risk management orientations. Reactive risk management is adopted by organizations clearly stating their risk acceptability levels. Those levels are expressed as specified objectives and then achieved through decisions made by applying rules based on quantitative analysis. Such orientation requires risk anticipation, its quantification and the specification of its effects. It constrains the actions of a given organization connected with risk management to the situations which the organization actually faces and is directly threatened by. Such oriented organizations prefer avoiding risk or transferring it to other entities.

However, C. Smallman (1996) claims that organizations successful in risk management are focused more on risk prevention, its reduction or acceptance by adopting a more proactive orientation in risk handling problems (as opposed to simply reacting to risk). Proactive risk management is based on the assumption that risk anticipation is constrained by the uncertainty experienced by decision-makers and that the environment of an organization is continuously changing. Thus, developing models which support the decision-making process, as well as the decision-making process itself, can be a significant challenge.

3. Review of risk analysis and management concepts and considerations connected with adopting them for the purposes of supply chain members handling with speculative risk

A broad review of different concepts of constructing the process of risk management conducted by the author of this paper has resulted in three main conclusions, namely:

- models of risk management process which consist of different number of phases (or steps) can be found in literature from different disciplines – there

can be found models consisting of three or four phases (e.g. Smith, Merritt, 2002), as well as models which are complicated constructs made of many more phases or steps (e.g. Scarf, Carty, Charette, 1993);
- because of the above-mentioned fact, the phases of risk management process proposed in the literature include different scopes and kinds of particular activities (e.g. some authors claim that risk analysis should precede risk management, while others state that it is just one of the components of risk management process;
- a significant number of authors (see: Carter et al., 1994; Zsidisin et al., 2000) emphasize that risk analysis and risk management should be separated processes, because the first one prepares decision-makers to manage risk – in other words, risk management is not feasible before risk analysis has been done properly.

The author of this paper agrees with the postulates that risk analysis should be treated as a separated process preceding risk management. Thus, as a starting point for further considerations, it is suggested to adopt the concepts of risk analysis and risk management discussed briefly below. When it comes to risk analysis, D. White (1995) states that this process should consist of three main phases:
- risk identification, which includes determining possible kinds of risk, as well as their sources, causes and effects;
- risk measurement (risk estimation), which includes determining risk probability and impact, risk description and quantification;
- risk assessment, which includes determining risk severity and acceptability from the perspective of an organization facing risk, as well as enlisting and comparing different positive and negative risk effects.

Properly constructed and clearly described is the risk management model presented by B. Carter, T. Hancock, J. M. Morin and N. Robins (1994). According to them, risk management process should encompass the following four phases: planning, organization, realization, and control.

It still needs to be recognized what specific attributes such constructed model of risk management should have in order to meet the requirements of handling speculative risk in organizations cooperating in supply chains.

According to J. Teczke (1996, p. 60), the speculative risk management model should be:
- highly flexible (to enable an organization to quickly react to environmental changes and new decision situations) and focused mainly on future events;
- functioning as an internal organization management tool which ensures to rationalize the process of planning, organizing, motivating and controlling different activities and it should encompass the whole organization;

- written in a business language to enable rational and objective decision-making on strategic, tactic and operational levels of an organization.

With reference to the cooperation between organizations in supply chains, P. Kajuter (1993) emphasizes that when they implement the risk management process, they should integrate it with the management of the whole supply chain. He also suggests primary rules to be considered when managing risk in a supply chain, namely:

- supply chain risk management requires close cooperation of this supply chain's entities;
- risk identification, made before risk management, should be conducted by all supply chain members continuously;
- open communication about the effects of risk identification is crucially important for the supply chain success among its members;
- when undertaking different actions in a supply chain, different kinds of risk which can influence each and every supply chain member should always be considered;
- supply chain risk should be managed effectively;
- risks which cannot be avoided or eliminated have to stay under continuous control of decision-makers in a supply chain.

When considering concepts, requirements and rules presented above, the author of this paper decided to construct risk analysis and management models proper for supply chain organizations handling with speculative risk. These models will be discussed in detail in the next part of the paper.

4. Models of supply chain speculative risk analysis and management

The general model of speculative risk analysis and management from the whole supply chain perspective is presented in Figure 1. (model A). This model places speculative risk analysis and speculative risk management processes in a broad context, including all members of the supply chain directly exposed to such kind of risk.

First, risk will affect directly the supply chain member which made a decision related to its business (company 'X'). However, because this is a member of a supply chain and cooperates with other members to achieve the goals and objectives of the supply chain, its decision will also affect its supply chain partners. Because the number of supply chain members can be significant, the model presents in a symbolic way the main parts/relations which can occur in such a complicated business network, i.e. the decision-making company, its direct customer

and supplier (as main parties of a transactional process) and its logistic service provider (as a facilitator of supply chain processes). Instead of a graphical presentation, it has to be emphasized that according to the ultimate supply chain concept, speculative risk as a result of decision made by one of supply chain members can affect (directly or indirectly) all its other members. What such a formulated model also indicates is that the process of speculative risk analysis should precede the process of speculative risk management. Moreover, these two subsequent processes should be integrated with the management system of each supply chain member and, at the same time, with the whole supply chain management system.

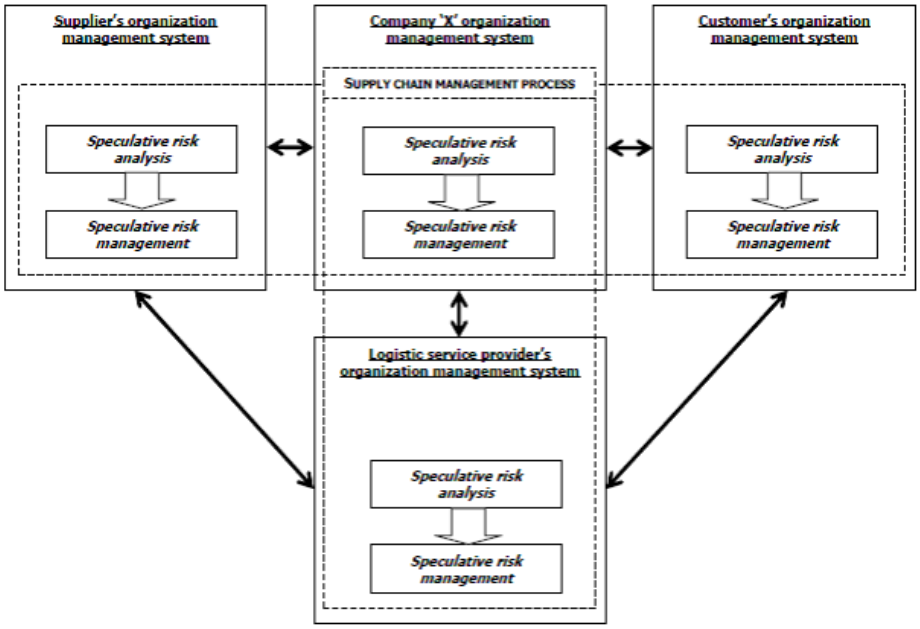

Figure 1. Model of speculative risk analysis and management from the whole supply chain perspective (Model A)

Because the model presented in Figure 1 provides only an overall view of supply chain speculative risk analysis and management concept, its fragment was extracted and described more precisely (see: Figure 2). In other words, Figure 2 illustrates a new model (model B) which presents supply chain speculative risk analysis and management concept from the perspective of bilateral relation in-between two given supply chain members. One of those is a decision-making company 'X', which is a source of speculative risk from model A and the other is one of its supply chain direct cooperators (it can be for example its customer, supplier or logistic service provider from model A).

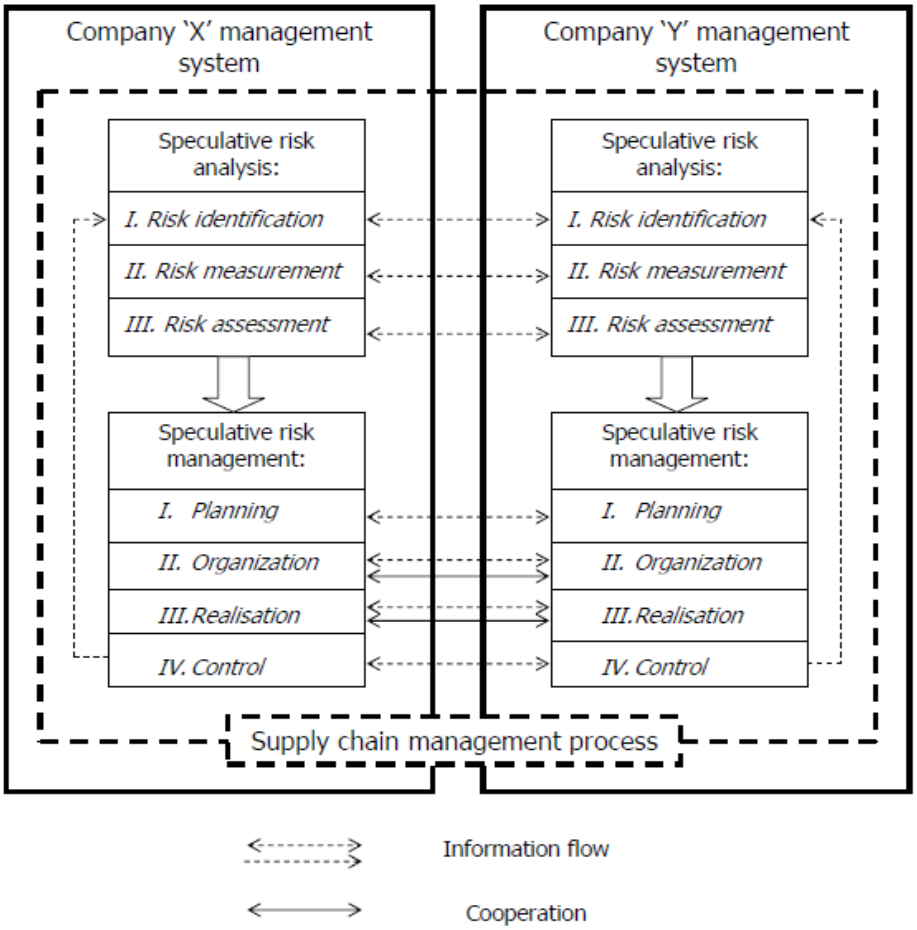

Figure 2. Model of speculative risk analysis and management from the perspective of bilateral relation in-between two given supply chain members (Model B)

The perspective adopted for model B purposes ensures a more detailed insight into the nature of relationship and cooperation between both presented companies needed to run a supply chain speculative risk analysis and management processes in a proper and effective way. Most of all, model B clearly indicates that a two-way continuous communication is necessary during the speculative risk analysis process, as well as during each phase of risk management. In other words, both partners should analyze speculative risk from their perspective and then inform each other about the results of such analysis. They should also share information about the effects of their efforts at each and every phase of the speculative risk management process. What is more, model B shows that the controlling phase of speculative risk management should ensure feedback necessary

for further risk analysis, which enables continuous improvement of the speculative risk management process. Model B also implies the necessity of compliance and coordination of both companies' activities during the organization and realization phases of the supply chain speculative risk management process in case of preventing suboptimal solutions.

5. Supply chain risk analysis and management initiatives

As a few risk analysis and management concepts have been already developed for supply chain purposes and very first pioneer-companies have already implemented their projects of supply chain risk management, today supply chain members should be more encouraged to start their own initiatives connected with their businesses. Two examples (one on supply chain risk analysis and one on risk management) of business initiatives are shown below.

IBM's product supply chains is a complex network of suppliers, manufacturing sites, and shippers. In it's risk analysis efforts IBM focused on its supply chain for the System X server product. Using probabilistic risk analysis the company achieved a comprehensive and unified perspective on risk factors affecting the supply chain: from frequent operational problems to rare but serious events, and from local delivery delays to industry-wide disruptions. The study also helped to quantify the impact of negative events on the cost and order-to-delivery time for supplying the servers to IBM's customers (WWW2).

Second example presents two different risk management attitudes towards risk and their effects. In 2001 lightning struck a Philips microchip plant in New Mexico, causing a fire that destroyed millions of mobile phone chips. Important Philips' customers were Nokia and Ericsson, the mobile phone manufacturers, but each reacted differently to that catastrophe. Nokia's supply chain management strategy allowed it to switch suppliers quickly; it even redesigned some of its phones to use both American and Japanese chips, which meant its production line was relatively unaffected. Ericsson, however, accepted Philips' word that production at the plant would be restarted in a week and took no action. That decision cost Ericsson more than $400m in annual earnings and finally the company lost its market share. By contrast, Nokia's profits rose by more than 40% that year (WWW1).

Conclusions

The aim of this paper was to present the models of risk analysis and management processes useful for the purposes of decision-makers in contemporary supply chains, based on broad literature review. Moreover, both models can be adopted for speculative risk handling, i.e. they can be used to reduce, avoid, transfer or mitigate risk which can cause negative effects, as well as to use the opportunities potentially beneficial for the supply chain. Still there is a need for further decomposition of presented models to operational perspective. Such a perspective would be best for the decision-makers willing to implement the concepts presented above in practice. Still, both suggested models can be very useful in order to understand the nature and role of speculative risk analysis and management in organizations cooperating in such complex structures as today's supply chains.

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(WWW2) ftp://ftp.software.ibm.com.

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THE CONFORMITY ASSESSMENT OF LEAD LOGISTICS PROVIDER AND THIRD PARTY LOGISTICS PREFERENCES USING ANALYTIC HIERARCHY PROCESS METHOD (AHP)

The dynamic development of logistics service industry has become apparent worldwide in the last several years. New types of logistics service providers have evolved: first of all 3PL and 4PL as well as to a lesser extend 5PL. Broad scale cooperation based on a new formula has begun – contract logistics. Service providers, on the basis of a contract with a business entity, taking over the performance of logistics functions in the long term, allow for achieving a *trade-up* effect within the logistic network. In this case, it is based on increasing the efficiency and effectiveness of supplies with a simultaneous reduction of logistics costs in a part of or in a whole logistics network. This effect would be unattainable without the participation of logistics service providers and constitutes a major prerequisite for their rapid development.

The decision to choose particular logistics service providers, however, is associated with a risk for all parties involved in the movement of goods. A 3PL service provider (or several such service providers) takes over from an enterprise the realization of key physical logistics functions; and moreover if it acts for a given enterprise as a Lead Logistics Provider (LLP), which is illustrated in Figure 1, then apart from physical functions, it also acquires managerial functions, resembling in this way a 4PL provider (Rushton, Walker, 2007; Schneider, 2010). The adaptation of logistics functions by service providers is also connected with the suppliers' and consignees' interference in logistics systems, and simultaneously "cuts" them from the entity commissioning logistics service, at least in the operational field. On the other hand the LLP, 4PL and 5PL providers become hubs, in which the flows of most important information in the logistics network intersect, which results in the fact that the entity starts to operate in a peripheral zone – with incomplete information. In all these cases there occurs partial or entire subordination of entity's logistics system to logistics service providers, who – providing services to other customers – do not have to aim at offering the highest standards of logistics services, but e.g. at optimalization of own resources utilization.

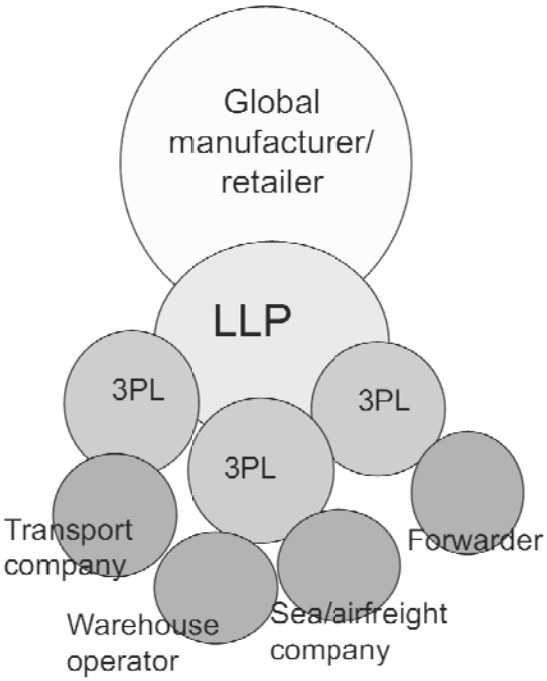

Figure 1. LLP and 3PL cooperation idea while servicing mutual customer

Source: (Williams, 2006).

Logistics services are often conducted under different market conditions than at the time of making the contract arrangements. It constitutes another thread for an entity because it is difficult to agree adequate scope and level of logistics services in advance.

As far as 3PL providers are concerned, the risk is connected with the lack of opportunities to use most effectively owned material resources while cooperating with a given customer. For the number of 3PL providers is so big that they are competing against each other for the best customers. The 4 PL and 5PL service providers' situation seems to be much better in this respect – as they do not use material resources – however the risk on their side also exists and lies in the fact that the functions they perform may be taken over by the LLP, and also by the customers themselves, after the implementation of appropriate network management software for logistics and its competent use.

The selection of a logistics service provider, a multi-criterion by its nature, is now one of the most important theoretical and practical dilemmas in logistics and many studies have been dedicated to it (e.g. Zhou, Min, Xu Cao, 2008). Numerous attempts to verify what aspects determine the proper cooperation of

the company and the logistics service provider can be found in the subject literature and, therefore, to the greatest possible extent, these aspects should be taken into consideration when making such decisions (e.g. Leahy, Murphy, Poist, 1995). A wide range of possibilities of using multi-criteria decision methods (MCDM) have also been provided, allowing for the objectivity of such a selection (see: Trzaskalik, 2008), out of which the Analytic Hierarchy Process (AHP) method, proposed by T.L. Saaty, is very popular. In the literature many research approaches using the AHP method have been described and its generalising extension – the method of Analytic Network Process (ANP) as well as regarding selection and evaluation criteria of a cooperation process with a logistics service provider, but authors focus here on the selection of a 3PL service provider by a client almost exclusively (for example: Kumar, Parashar, Hale, 2009). Still the literature considerably less frequently addresses the issue of 3PL provider selection (as a service provider of a lower order) by the LLP or 4PL (higher order) before the beginning of vertical cooperation* for the purpose of servicing a mutual customer. As one of the few studies can be quoted here: Xu, Zhang, Tang (2010).

This article attempts to examine the LLP service provider's preference conformity, in the course of choosing a 3PL service provider, with 3PL preferences, which are used by it while designing own logistics services offer. Two entities were qualified for the research, which cooperated with each other horizontally at the time of research (December 2011), but they have not engaged in vertical cooperation yet. The horizontal co-operation takes place within the *Silesia Logistics* cluster formed at the beginning of 2012 and it primarily embraces joint ventures in the field of investment, education, and image building for the partners involved and the region itself. One of the entities is a 3PL cluster service provider, belonging to a global group offering this kind of logistics services. By contrast the other entity is a highly specialized LLP provider, belonging to a group focused on servicing the automotive industry. The representatives of both entities were persons of very high logistics knowledge, able to look systematically at logistic cooperation, maintaining a direct contact with recipients of services.

The study was based on the classic AHP methodology, however, limited to determining the preference vectors of both entities. Then the compliance of set preferences was assessed using the Index of Dissimilarity and Relative Index of Similarity, and on the basis of the preference rankings charts. Due to the fact that the AHP method is extensively described in the literature, the study primarily focused on describing aspects of cooperation between the researched service providers and the obtained results while omitting some calculations. Although,

* In fact, 3PL and LLP cooperation is quasi-vertical. A mutual customer service often requires from them performing parallel logistics operations.

as it has been mentioned earlier, many important aspects of vertical cooperation among the logistics service providers can be indicated, the AHP methodology, however, has imposed a restriction in the form of maximum nine aspects that could be subjected to reliable research (Saaty, Ozdemir, 2003). These aspects, presented in Table 1 and briefly described below, were chosen on the basis of preliminary discussions with various logistics service providers, before the proper research.

1. *Accuracy of provided services* means that the service is delivered by the 3PL every time strictly according to previous arrangements between the parties as to the quantity, structure, and quality conditions, such as the way of packaging, the sequence alignment, etc. This aspect is often indicated in the literature as the most important in the whole logistics services (in addition to the timeliness of deliveries).

Table 1

Selected cooperation aspects for testing 3PL and LLP preferences compliance

Symbol	Cooperation aspects
a_1	Accuracy of provided services
a_2	Flexibility in service delivery
a_3	Cost of services offered
a_4	Possibility of fast, cost-free termination of cooperation
a_5	Goodwill of service provider
a_6	Financial stability
a_7	Range of logistics services offer
a_8	Timeliness of service delivery
a_9	Exchange of information

2. *Flexibility in service delivery* means adjusting the 3PL to the changing conditions in which logistics services are completed; it both refers to the way they are provided, as well as the infrastructure used. This aspect is important due to the fact that logistics service consists of so many components that it is practically impossible to consider all options in the contract.
3. *Cost of services offered*, it primarily refers to providing the lowest rates for logistics services on the basis of actual costs incurred, adjusting the degression or progression rates thresholds to the customers' expectations, as well as a tariff structure constructed on the most convenient basis for the customer.
4. *Possibility of fast, cost-free termination of cooperation* is a necessary aspect reducing the risk of the need for continued cooperation, or the need to pay

damages in a situation where for at least one of the parties it would appear reasonable to stop it.

5. *Goodwill of service provider* increases the confidence in all entities that directly or indirectly benefit from the logistics service. Goodwill means responsibility and experience in the market and allows for commissioning a service provider to perform key logistic functions.
6. *Financial stability of a service provider* is an aspect positively influencing the cooperation of service providers – not only does it allow the parties to employ high-class specialists, invest in modern logistics technologies, and maintain good infrastructure, thereby reducing the risk of interruption in service, but also it allows for mutual assistance in times of reduced profits, along with the commissioning company (e.g. deferring a payment, acquisition of foreign exchange risk, etc.).
7. *Range of logistics services offer* – in the conducted studies this aspect means the wide range of services availability. However, in relation to the width of the offer, LLP expectations or the commissioning company may be different than the assumptions that 3PL has made. Driven by the desire to reduce the market risk 3PL offer should be wide and provide the opportunity to work with multiple customers. On the other hand – many industries look for specialized service providers, focusing exclusively on satisfying the needs of one customer.
8. *Timeliness of service delivery* means ensuring that individual logistics operations will be performed each time according to predetermined schedule. It mainly applies to deliveries within narrow time frames for Just-In-Time on the cross docking or assembly lines of the LLP or the commissioning company.
9. *Exchange of information*, this aspect relates to offering high quality information flows and coordination of planning, among the logistics network hubs, by the service provider. In practice this means the ability to use logistics management software coupled with the software of the service commissioning company, its suppliers and customers, and other logistics service providers involved.

Using these aspects, in accordance with the AHP method, two research tabulation sheets were built, one for each of the providers. The sheets consisted of pair lists of all aspects. The number of necessary pairwise comparisons has been described by formula:

$$L_p = \frac{n^2 - n}{2}$$

where: L_p – number of comparisons in pairs, n – number of aspects selected for research.

Therefore, it was necessary to prepare 36 lists in each sheet for the nine aspects. In order to assess preferences a standard scale for AHP has been used, which is shown in Table 2. The AHP method usually describes the importance of symbols with odd numbers only, because of the difficulty in drawing the names for the intermediate ratings. The symbols with even numbers are used for answers situated between the odd, for example – the choice of 4 means a rating between "slightly more important" and "clear preference".

Table 2

Comparisons scale between selected aspects

Symbol	Verbal evaluation comparing each pair
1	Equilibrium
3	Slightly bigger importance
5	Clear preference
7	Very strong preference
9	Absolute preference, dominance

A fragment of a sheet, which was filled in by the investigated persons, is presented in Table 3. The respondents were asked to rate each pair of aspects and to select one of preference degrees or the balance between the aspects.

Table 3

A fragment of a sheet used in the study

		9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
		Absolute preference, domination		Very strong preference		Clear preference		Slightly bigger importance		Equilibrium		Slightly bigger importance		Clear preference		Very strong preference		Absolute preference, domination	
1	Accuracy of provided services																		Possibility of fast, cost-free termination of cooperation
2	Exchange of information																		Goodwill of service provider
…	…																		…
36	Flexibility in service delivery																		Timeliness of service delivery

As a result two matrices of pair assessments of particular aspects were obtained. They have been presented in Table 4 (for the 3PL service provider) and Table 5 (for the LLP service providers). For example, in the first matrix: rating 5 in a2 row and a3 column means "clear preference" of provided logistics services flexibility over their cost.

Table 4

The matrix of pairwise ranking – 3PL provider

	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9
a_1	**1**	1/3	4	5	1	1/2	1/3	1	1
a_2	3	**1**	5	5	2	1/2	1	4	3
a_3	1/4	1/5	**1**	2	1/4	1/4	1/4	1/3	1/4
a_4	1/5	1/5	1/2	**1**	1/4	1/5	1/5	1/4	1/4
a_5	1	1/2	4	4	**1**	1/2	1	1	1/3
a_6	2	2	4	5	2	**1**	2	2	2
a_7	3	1	4	5	1	1/2	**1**	3	4
a_8	1	1/4	3	4	1	1/2	1/3	**1**	2
a_9	1	1/3	4	4	3	1/2	1/4	1/2	**1**

Table 5

The matrix of pairwise ranking – LLP provider

	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9
a_1	**1**	3	1	5	5	1	7	1	3
a_2	1/3	**1**	1	3	1	1	3	1/3	3
a_3	1	1	**1**	5	1	1	7	1	3
a_4	1/5	1/3	1/5	**1**	1/3	1/5	1/2	1/3	1/5
a_5	1/5	1	1	3	**1**	1/3	3	1/3	1/7
a_6	1	1	1	5	3	**1**	5	1	3
a_7	1/7	1/3	1/7	2	1/3	1/5	**1**	1/3	1/3
a_8	1	3	1	3	3	1	3	**1**	3
a_9	1/3	1/3	1/3	5	7	1/3	3	1/3	**1**

The resulting sets of ratings were checked for internal consistency. For this purpose, the Consistency Ratio (CR), proposed by Saaty, was used according to the following formulas:

$$CR = 100 \times \left(\frac{CI}{RI}\right)$$

$$CI = \frac{(\lambda_{max} - n)}{(n-1)}$$

where:
CR – Consistency Ratio,
CI – Consistency Index,
RI – Random Consistency Index, which should be read from the Table 6,
λ_{max} – Maximum Matrix Eigenvalue,
n – rank of matrix (the number of studied aspects),

Table 6

Random Consistency Index (R.I.) depending on matrix size (*n*)

Matrix size *n*	3	4	5	6	7	8	9
Random Consistency Index *R.I.*	0.52	0.89	1.11	1.25	1.35	1.40	1.45

Source: (Saaty, Vargas, 2001).

The largest Maximum Eigenvalues of the matrices were calculated with the use of the Matrix and Linear Algebra 2.3 Package* for Microsoft Excel ®. Consistency Indexes and Consistency Ratios are respectively: – for the matrix of 3PL provider:

$$CI = \frac{(9{,}7047-9)}{(9-1)} \approx 0{,}0880$$

$$CR = 100 \times \left(\frac{0{,}0880}{1{,}45}\right) \approx 6{,}08\%$$

– for the matrix of LLP provider:

$$CI = \frac{(10{,}0973-9)}{(9-1)} \approx 0{,}1371$$

* The package is available at: (WWW1). This package has also been used for further preference vectors calculations.

$$CR = 100 \times \left(\frac{0{,}1371}{1{,}45}\right) \approx 9{,}46\%$$

The sets of ratings can be considered consistent, and therefore they can be used to determine the preference vectors, if the quantities of CR < 10%. In both cases, this condition has been fulfilled. The calculated preference vectors (i.e. Matrix Eigenvectors Maximum) are presented in Table 7.

Table 7

Preference vectors of 3PL and LLP service providers

Studied aspect	Preferences	
	3PL	LLP
Accuracy of provided services	8.76%	19.59%
Flexibility in service delivery	19.24%	10.73%
Cost of services offered	3.26%	14.88%
Possibility of fast, cost-free termination of cooperation	2.51%	2.74%
Goodwill of service provider	9.39%	6.51%
Financial stability	20.00%	15.56%
Range of logistics services offer	18.01%	3.10%
Timeliness of service delivery	9.01%	16.53%
Exchange of information	9.82%	10.37%

The compliance of the designated preferences was assessed by using the Index of Dissimilarity and Relative Index of Similarity. The first indicator was calculated on the basis of the formula (Kestenbaum, 1980):

$$D = \frac{1}{2} \times \sum_{i=1}^{n} |W_{1i} - W_{2i}|$$

where:
D – Index of Dissimilarity,
W_{1i} – calculated i-th 3PL preference,
W_{2i} – calculated i-th LLP preference,
n – the number of aspects studied.

While the Relative Index of Similarity was determined according to formula (Kornacki, Wesołowska-Janczarek 2008):

$$Z = \frac{\sum_{i=1}^{n} min\ (W_i)}{\sum_{i=1}^{n} max\ (W_i)}$$

where:
Z – Relative Index of Similarity,
W_i min – smaller of the i-th preferences,
W_i max – greater of the i-th preferences,
n – the number of aspects studied.

Both indices take values from the interval <0;1>. The D ratio indicates what percentage of preferences should be changed (here: to move into other aspects of logistics cooperation) so the structures will become identical. The Z indicator shows what percentage of the preferences of both studied parties coincides. When Z = 1 structures are identical, while for Z = 0 structures are completely different. In the case of surveyed service providers the preference vectors are D = 0.307 and Z = 0.530. According to the first of the indicators in order to get the full compliance of the preference structures, figuratively speaking, about 30% of the preferences of each service provider should be changed. The second indicator shows that only just over half the respondents' preferences coincide. Both indicators confirm that rankings of preferences are very far from compliance, which at first may be surprising, given that the business activity of both entities is similar. In order to be able to draw conclusions from the studies the comparative rankings of 3 PL and LLP preferences have been presented in the Table 8.

Table 8

Preference rankings comparison of researched service providers

3PL preference hierarchy	Position	LLP preference hierarchy
Financial stability	1	Accuracy of provided services
Flexibility in service delivery	2	Timeliness of service delivery
Range of logistics services offer	3	Financial stability
Exchange of information	4	Cost of services offered
Goodwill of service provider	5	Flexibility in service delivery
Timeliness of service delivery	6	Exchange of information
Accuracy of provided services	7	Goodwill of service provider
Cost of services offered	8	Range of logistics services offer
Possibility of fast, cost-free termination of cooperation	9	Possibility of fast, cost-free termination of cooperation

Large discrepancies can be noticed while comparing the rankings of preferences. Several aspects were evaluated differently: the accuracy of provided services is not considered as a priority by 3PL, and it even can be found at one of the last places, on the other hand this is what above all is expected by LLP. Similar differences concern the timeliness of delivery and cost of logistics services. It seemed that the key aspect of accuracy, timeliness and cost of logistics services, has already become a canon in contemporary logistics. Compatibility between the studied 3PL and LLP virtually exists only in reference to long-term willingness to engage in the logistics cooperation, which may not be completed, taking into account the remaining incompatibilities. It is visible in the fact that 3PL is more focused on assuring its own benefit, while the LLP is primarily guided by the value for the customer. 3PL is an entity with greater versatility, looking for emerging market opportunities. It is not as tied to a specific client, or a specific logistics network, as LLP.

The issue of implementing possible changes in preferences by both parties, in particular by the 3PL, which could occur before undertaking a possible cooperation, remains a challenge for further research.

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DEDICATED LOGISTICS PROVIDER FOR BLOOD DONATION PURPOSES ON THE EXAMPLE OF BLOOD SUPPLY CHAINS MANAGEMENT IN POLAND

Despite prolonged downturn in many European countries, including Poland, the service sector has been experiencing constant development. This applies to logistics in particular, which thanks to operations of transport, freight forwarding and storage is dubbed the barometer of economic growth. The logistics service sector i.e. providing broadly defined logistics services is currently expanding at a vast rate of knots, both in terms of GDP contribution as well as the number of operating companies – 146 thousands and industry employment – 622 thousands (Polish Transportation Report…, 2011, p. 24). Logistics companies found themselves in this favourable position due to high flexibility and venturing forth with risky business undertakings.

The global character of today's marketplace and threat from global competition mean that companies are forced to stay on top of their game through exploring new and ever-efficient ways to run their business which ultimately aims to translate to commercial success. In this case, success means more customer-centric approach and operating in profit centers[*]. Exploring new opportunities for running the business is nothing but catering for ever-higher customer needs. Today's client will not just settle for mediocre, satisfactory services, but often expects provided services to be ahead of his expectations, whilst being a comprehensive, coherent and quick-to-deliver service. Thus, the question should be answered: how all that will impact on logistics service providers? What this means, is undertaking actions to grab customer attention and reach wide audiences. However, in order to deliver on those objectives, one has to explore the issues facing customers from the standpoint of end-consumer. This boils down to reorganisation of the traditional and creating a modern Value Chain. A modern Value Chain is customer-centric, revolves around customer needs, priorities and opportunities to satisfy them. The client constitutes the first and critical link in the chain, subsequently resources and key competences are taken into account.

Taking into account the aforementioned, one should consider delegation of operating the blood supply chain[**] management[***] which caters for blood donation in Poland, composing 21 independently operating regional blood donation

[*] A profit centers are an area of business environment from which the company can drive profits.

[**] blood supply chain – cooperating public blood service organisational units as well as blood donors and receivers, between whom the flows of blood and blood components and connected information are realized. See (Szołtysek, Twaróg, 2009, p. 18).

[***] blood supply chain management means decision procedures concerning: 1) integrating physical flows and information flows of blood and its components between supply chain actors, 2) synchronising blood supply (donations) with demand for blood and its components in order to benefit health of individuals receiving blood and its components, assuming highly efficient blood supply system. Managing those chains might pose a considerable challenge to chain managers, among other (or above all) due to unpredictability of blood demand. See (Szołtysek, Twaróg, 2009, p. 19).

and hemotherapy centres (RBDaHC), to a logistics operator and conditions of such arrangement[*].

This option should be realistically considered only when RBDaHC (being partner in supply chain), having realised the need to implement logistics management: 1) will delegate the issue-related tasks to its own employee and fail to quickly obtain resources (material and human resources) required to logistically manage blood supply chain, and a decision will have been made for RBDaHC to assume responsibilities of blood supply chain coordinator; 2) will make the decision to delegate medical and logistics tasks, while trusting the latter with professional logistics service provider. Then, key logistics competences have to be found in organisational environment. This involves identifying the competent entity, which on behalf and to the benefit of RBDaHC would take over duties related to managing flows (blood and its components, information, supplies and other) within blood supply chain i.e. would control it. In practical terms, that would mean all supply chain partners have to voluntarily follow the lead of an objective entity, which has an active interest in optimising the supply holistically (Hoppe, 2009, p. 111) – logistics provider. In that way, the logistics provider engages in managerial relationships within the finally formed, wider supply chain. Note that logistics providers (in line with declared affiliation with specific entities) vary from ordinary carriers and operators offering package of services (tailored to specific customer needs) to 3PL operators (*Third Party Logistics*) or even 4PL (*Fourth Party Logistics*)[**]. Mentioned last group are entities which own assets, key managerial competences in logistics capable of expanding their skill base, especially creating information systems based on experiences and specialist knowledge (See: Kempny, 2008, p. 22).

3PL operators (4PL as well) are experienced in efficiently managing supply chains within business environment, to a lesser extent – within humanitarian environment. One should spare a thought, whether a versatile logistics provider would guarantee, or incentivise integration of blood supply chains operating within social areas (social logistics)[***], where human rights play a key role in making economic and organisational decisions[****].

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[*] This paper is based on a research project by S. Twaróg entitled *Logistic aspects of blood supply chain management in Poland* (N N115 411040), project managed by prof. Jacek Szołtysek.

[**] or superior, listed in reference books, which are not commonly classified and doubts are cast over their viability and usability.

[***] Social logistics – *is the art of efficient management of material flows and associated, socially valuable information, in order to create particular spacetime values (and complementary goods) which are needed by the society and assure its well-being.* (Szołtysek, Kołodziejczyk, 2009, p. 22).

[****] Proper integration means adhering to social logistics principles in management. When managing blood supply chains, decision makers should underpin their decisions with social and organisational rationale when taking decisions.

Logistics operators tend to address the ever-frequently articulated needs concerning demand for specialist logistics services signalled by organisations operating in the health care industry and humanitarian aid, by offering bespoke package of services. Thus far, however, performance of those companies, where under normal operating conditions logistic teams deal with budget-tight circumstances, was not satisfactory for ordering parties. This is due to demanding from logistics providers to redefine their bundle of goals when making operational decisions. At the heart of the issues lies the fact that here effectiveness should have higher priority than operational efficiency. Decision support systems used by 3PL operators usually do not adhere to that requirement. Also the personnel, educated by the Polish education system and polished off through practical experience, displays subdued social sensitivity, strongly stagnated and consolidated cost-saving habits thus the decisions they make are business-savvy as opposed to humanitarian.

In the spirit of this discussion, note that independently of logisticians' competences which should be developed differently today (Szołtysek, Otręba, Twaróg, 2012, pp. 543-551), the decision about selecting a logistics provider should be based on skillset addressing the needs of particular blood supply chain. 3PL operators seem to be a good choice for integrating blood supply chain at the preliminary stages. Displaying the aforementioned skill set, is according to S. Hertz and M. Alfredsson (2003, pp. 139-149) enables distilling four types of 3PL logistics providers (Figure 1):

- standard logistics providers – the most fundamental form of logistics provider. These companies provide services including transport, storage and distribution as core logistics functions.
- service developer – these logistics providers, on top of fundamental services, provide value added services as under normal business conditions: *cross – docking*, packaging and bespoke services. In order to deliver on delegated tasks, service providers require a reliable information system.
- customer adapter – logistics provider operating upon client request, by taking over completely its logistics operations. The 3PL provider improves logistics dramatically and rapidly. Their actions are aimed to provide core services at the cost of developing new services.
- customer developer* – this is the highest level that a 3PL provider can attain with respect to its processes and activities. This occurs when the 3PL provider integrates itself with the customer and takes over their entire logistics function. The ability to collaborate with customers relies on *know – how*, developing knowledge and designing supply chain.

* This type of logistics provider might resemble the one referred to by Anderson Consulting as logistics integrator.

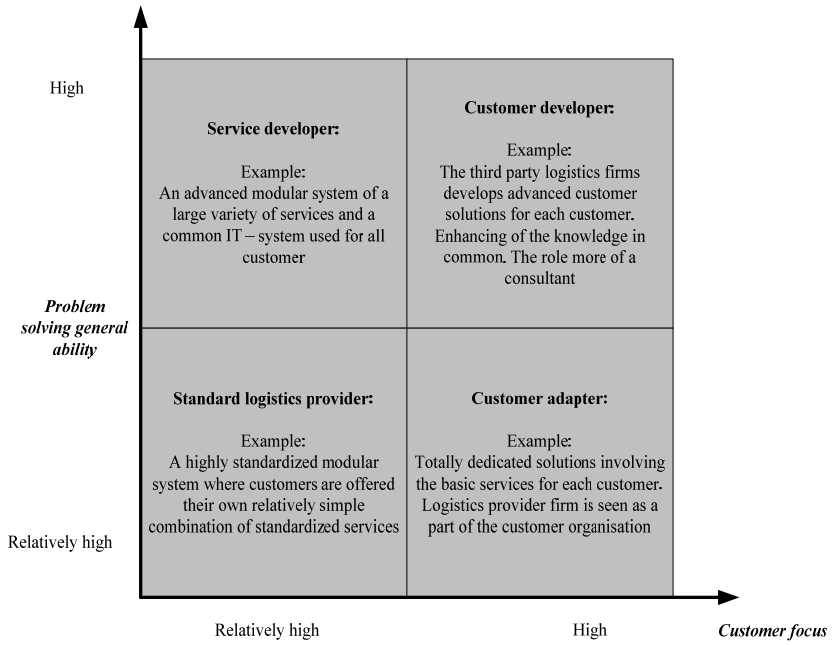

Figure 1. Classification of logistics providers, according to the ability of problem-solving and meeting customer expectations

Source: (Hertz, Alfredsson, 2003, pp. 139-149).

By taking into account logistics needs of blood supply chain management, when logistics becomes ever-important for efficient operation of the entire blood donation system and there are no traditionally developed logistic structure, medical and quasi-medical competences are the absolute top priority upon choosing 3PL provider, then a customer developer (dedicated logistics provider) should be considered.

The aforementioned doubts concerning aligning qualifications and experiences of logisticians with specific demands of blood supply chain management suggests looking for desired 3PL provider among new, purpose-established entities, which own their own, right-for-the-job assets, organisational structure, objectives and communication mechanisms. Under domestic conditions, such entity would own resources related to National Blood Services and logistics operators. Nevertheless, bearing in mind experiences from other fields*, where management and core values are different, it is fair to say that such "event"

* Widely described in the articles on new logistics applications, for example: (Szołtysek, Otręba, Twaróg, 2012, pp. 543-551; Szołtysek, Twaróg, 2011, pp. 23-31).

would cause a multitude of conflict and would have negative impact on blood supply chain management. The alternative for appointing a dedicated logistics operator is delegating the function of blood supply chain coordinator to companies operating on the Polish market, which are experienced in providing unusual services. Competitors forced to share the market with many logistics provider have to engage in a kind of market game. It is based on the win-win rule and the premise is that each logistics operator (offering similar services to its competitors), strives to find an element/service differentiating its from the others. Said element/service: 1) is difficult to copy by the competition; 2) is innovative to a various extent; 3) would have to entice customers and retain them long-term; 4) put the company ahead of the curve and in front of the competition.

Undertaking actions aimed to give position of dedicated logistics provider involves above all specialisation of logistics services designed for specific industries, including the medical industry. High barriers to entry due to required infrastructure, IT systems and highly specialist know-how, considerably limit the viability of operating on a niche market. Usually, niche sectors are serviced by companies which thanks to owing the required skill set and resources are fully capable of taking advantage of market opportunities and willing to take the inherent risk. Hence, it is fair to say that the position of dedicated logistics provider is not for every company offering logistics services. Instead, it is exclusively reserved for some logistics providers. Among such companies operating on the Polish market are *FM Logistics* and *DHL*.

FM Logistics not only does transport medicine and medical equipment as part of logistics operations for the medical industry, but also human organs saving lives. In order to address special requirements of this operation, it created a system encompassing medical facilities (hospitals, pharmacies, wholesalers) as well as individual patients. Services provided by *FM Logistics* comply with provisions of the Good Distribution Practices code, and are delivered using correct tools, which are under constant supervision from Main Pharmaceutical Inspectorate (Janicki, 2010, pp. 8-9).

DHL on the other hand, had launched its *Medical Desk* aimed at pharmaceutical industry companies (clinical trials) and medical companies (health care, laboratories, scientific centres). That department specialises in dealing with temperature-sensitive parcels, such as medical samples (sent for laboratory experiments) and laboratory research results from academic scientific centres. *DHL* have duly expanded its logistics network and technological support – it created a wide range of packaging varying by weight and storage capacity, maintaining constant temperature over given time period (WWW1).

Hence, blood supply chain coordination can be delegated to purpose-established company with its own, fit-for-the-purpose assets, organisational structure, objectives and communication mechanisms. This solution might spark a multitude of conflicts and could have a negative impact on blood supply chain management. Delegating control to an external entity, specialised in providing a wide range of logistics services could be a potentially alternative solution. The decision to collaborate with an external entity might not be the easiest one. A successful decision, on the other hand, would increase efficiency of blood supply chain, while a wrong one would generate additional costs, blood supply chain losses and diminishing the value* of organisation among its stakeholders.

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* In case of blood donation this refers to non-material values.

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AN IDENTIFICATION OF THE "RIPPLING EFFECT" IN THE TRANSMISSION OF DISRUPTIONS IN SUPPLY CHAINS. THE DILEMMAS OF THEORETICAL STUDY AND EMPIRICAL RESEARCH

1. The transmission of disruptions in supply chains

The negative effects of risk, often referred to as disruptions, may directly or indirectly affect supply chains. The direct impact of disruptions can be triggered by exogenous or endogenous risk factors. Exogenous risk factors are external to a supply chain and located outside its boundaries. They fall into a wider macro-environment level or sector, whereas endogenous risk factors are embedded inside a supply chain, its participants or relationship between them(Rao, Goldsby, 2009, pp. 97-123; Tang, 2006, pp. 451-488; Peck, 2004, pp. 210-232; Cavinato, 2004, pp. 383-387).

In practice, the risk of adverse effects caused by certain factors is often transferred to other links in a supply chain. It means that the negative effects of risk are extended beyond the boundaries of individual firms and thus indirectly transferred to other companies. The propagation of negative effects of risk from one company to others as a result of an indirect impact of certain risk factors may be referred to as the transmission of disruptions.

The transmission of disruptions means that the negative effects of risk are extended to a larger number of participants in a supply chain. The primary source of these disruptions are exogenous and endogenous risk factors. Therefore, it may be assumed that the transmission of disruptions requires at least two companies of a supply chain to be involved in a process. One company is affected by a direct impact of these risk factors, and the other is affected by an indirect influence. The idea of the transmission of disruptions in a supply chain is depicted in Figure 1.

As illustrated in Figure 1, exogenous or endogenous factors affect a supplier directly, causing a certain disruption, which is then transmitted inside the structure of a supply chain to other participants. In this case, the supplier is the initial link, while the actors at other levels of material flow in the supply chain – producer and customer – are exposed to an indirect impact of risk factors. It is assumed that there ought to be an indirect impact of risk factors in the transmission of disruptions.

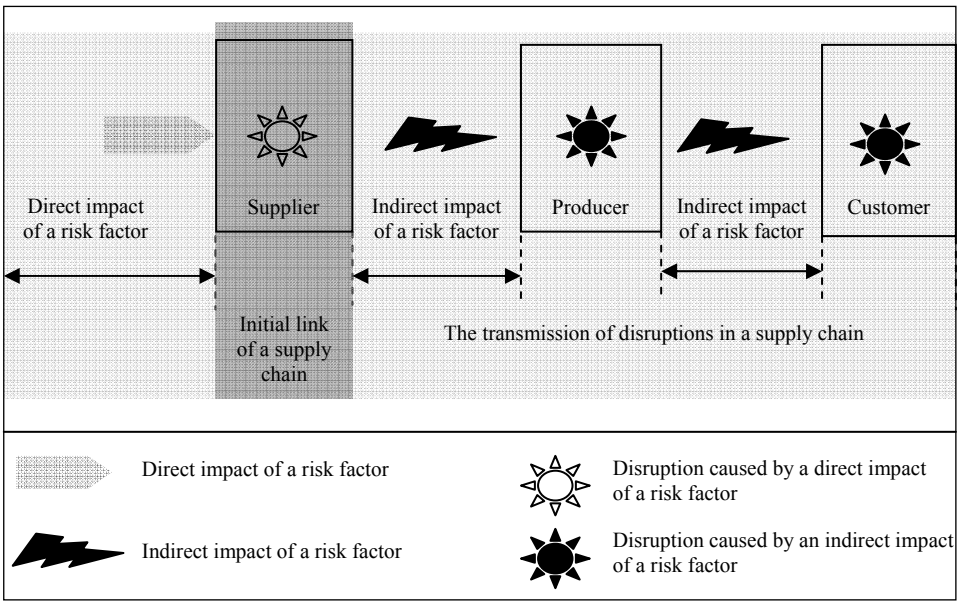

Figure 1. The schematic diagram of the transmission of disruption in a supply chain

The negative risk effects may spread to a larger number of participants in a supply chain. The range can be varied, but it generally falls within two types of disruptions located in the extreme positions of the continuum:

- limited range of disruptions, usually bilateral;
- widespread disruptions, generally holistic (Svensson, 2000, pp. 731-749).

In the limited range of disruptions, the negative effects of risks are transmitted to a small number of links in a supply chain (Svensson, 2000, pp. 731-749). For the purpose of this paper, this range consists of only two companies, which determines the transmission of disruptions from one company to the other (Kersten, Hohrath, Böger, 2007, p. 4). It is not important if a disruption in the first link is caused by endogenous or exogenous risk factors. At the other extreme continuum outlining the transmission of negative effects are widespread disruptions. The transmission of these disruptions affects all actors in a supply chain.

In general, the effects of risks are positioned between the two poles of limited range and widespread disruptions. As a result, a certain number of actors participating in a supply chain will be exposed to the negative effects of risk.

2. The characteristics of the "rippling effect" in the transmission of disruptions in a supply chain

The disruptions may be amplified during the transmission in a supply chain. It means that each successive link in a supply chain can be exposed to stronger effects of risks. The amplification of disruptions during the transmission may be referred to as the "rippling effect". This phenomenon is illustrated in Figure 2.

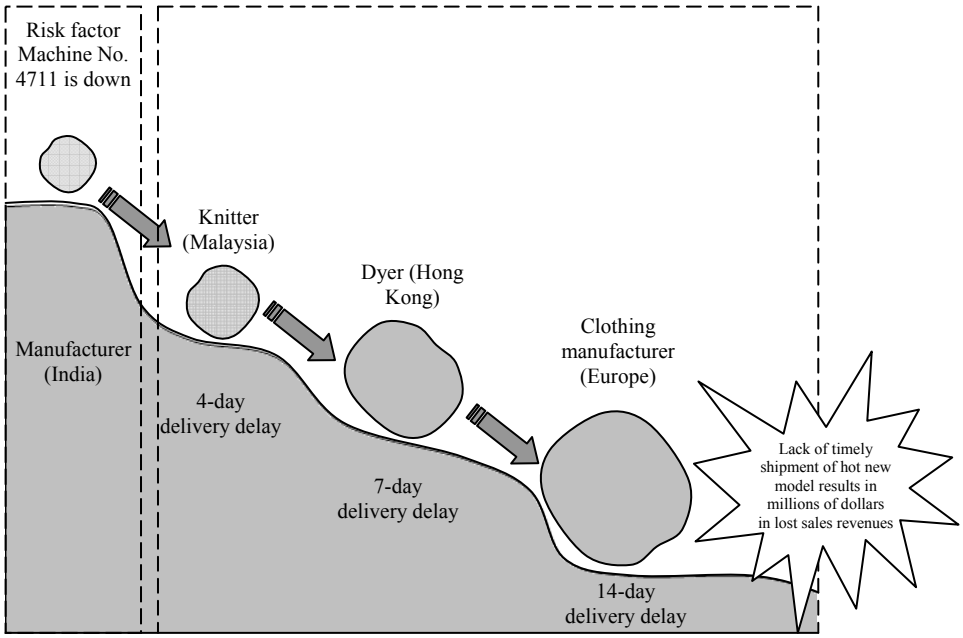

Figure 2. The "rippling effect" in a supply chain

Source: (Radjou, Orlov, Nakashima, 2002. p. 3).

As depicted in Figure 2, the malfunction of a machine at the manufacturer in India caused a delivery delay, which was then amplified during the transmission to subsequent links in the supply chain.

The transmission of amplified disruptions may cause new effects, different from the original ones. For example, the terrorist attack in the United States on September 11th, 2001 caused the government's response to the attack: closing borders, shutting down air traffic and evacuating buildings throughout the country. These additional effects affected supply chains operating in Europe and USA. For example, as a result of transportation restrictions, the supply chains in the automotive industry – Toyota and Ford – experienced several days of

disruption in the continuity of supply of components to the factories located in the north of the country (Sheffi, 2001, pp. 1-11).

Another good example are the epidemics which provoked national crises, affecting many organizations involved in supply chains. The extent and severity of the consequences caused by the risk of foot and mouth disease or BSE particularly affected the European supply chains. The "rippling effect" was a result of European governmental response to the direct effects of the outbreak among livestock (Peck, 2005, pp. 210-232). The infection of cattle as a consequence of the direct impact of epidemic led to the imposition of additional formal restrictions on manufacturing and distributing meat products. It caused several disruptions in the supply chains operating in the food industry. On the other hand, the fuel supply chains experienced additional disruptions associated with road transportation. They were caused by the authorities' decision to place disinfectant mats at roadside checkpoints.

The issue of the "rippling effect" in supply chains is complex and multifaceted, so the empirical study may pose many difficulties. There are two closely related phenomena employed in the "rippling effect", namely the range of transmission and the amplification of disruptions. The confrontation of these two phenomena is presented in Figure 3, which enables us to identify the following situations:

- mitigation of disruptions in the transmission to a smaller number of firms in a supply chain;
- mitigation of disruptions in the transmission to a larger number of firms in a supply chain;
- amplification of disruptions in the transmission to a smaller number of firms in a supply chain;
- amplification of disruptions in the transmission to a larger number of firms in a supply chain.

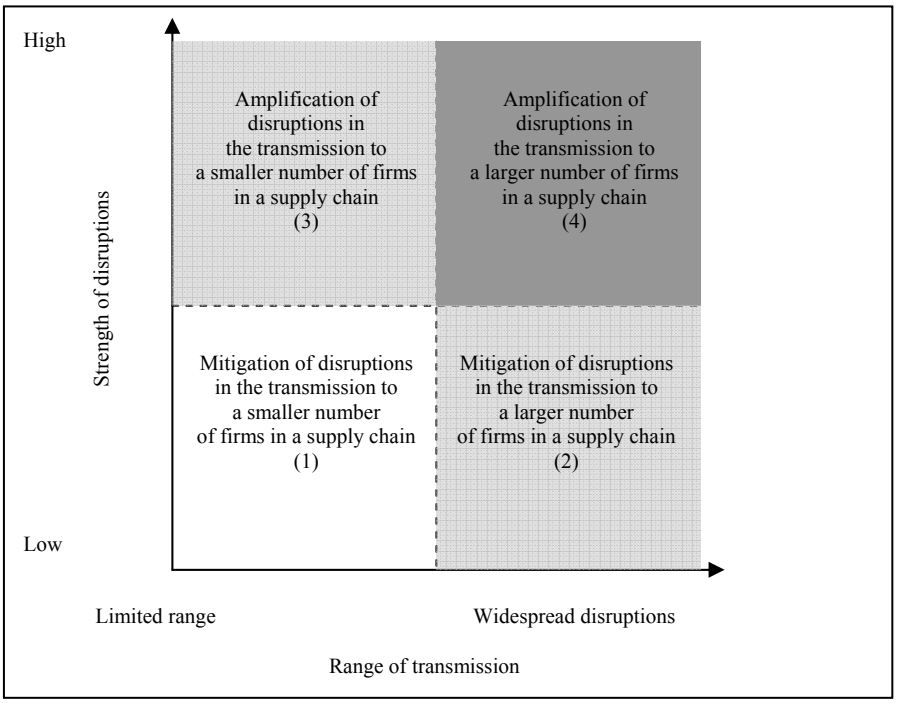

Figure 3. Matrix of the range of transmission and the strength of disruptions

The most interesting situation of the "rippling effect" are the disruptions which were amplified and transmitted to a larger number of firms in a supply chain. However, the relationships between the range of transmission and the strength of disruptions are only illustrative. It is rather uncommon that the effects of risk are transmitted to all companies in a supply chain, having a holistic impact. On the other hand, the disruptions are not only amplified in the transmission, but they may also be mitigated.

It is also important to identify the risk factors which are sources of disruptions amplified during the transmission. The most difficult to identify is the transmission of disruptions caused by the risk factor which directly affects a larger number of companies in a supply chain (Cheng, Kam, 2008, pp. 345-360). Risk factors such as natural disasters or financial crises often simultaneously and directly affect a larger number of links in a supply chain (van Dorp, 2004, pp. 240-255). The disruptions caused by this group of risk factors are not sequential in their nature and are often interdependent (van Dorp, Duffey, 1999, pp. 17-29). The particular risk factor which affects a larger number of companies in a supply chain may be referred to as "common risk factor". In practice, it is very often an exogenous risk factor.

3. The identification of the "rippling effect" caused by a "common risk factor"

The purpose of the identification of the "rippling effect" is to determine all disruptions that are likely to be transmitted in structures of supply chains (Khan, Burns, 2007, pp. 197-216). In practice, one can use several methods for collecting information about the "rippling effect". These include the experience of managers, the use of decision support systems, conducting surveys, "brainstorming" or recourse to the external consultants (Hillson, 2002, pp. 1-11). However, from the institutional point of view, the use of such methods should be complemented with a definition of the scope of diagnosis. In other words, it is important to identify the specific characteristics of links relevant from the perspective of the "rippling effect". Gilbert and Gips argue that while it makes sense to consider potential disruptions at the supplier's suppliers, it is less understandable and may be more costly to read the effects of risk at further stages of a supply chain structure. Hence, the key issue to resolve is to determine the scope of diagnosis outlining how many links are to be involved in the identification process (Gilbert, Gips, 2000, pp. 70-74).

The problem is that the "rippling effect" may not even be observable in particular situations. It means that the disruptions occurring in a specific link of a supply chain are not necessarily amplified during the transmission. In this case, time and financial expenditures incurred in relation to the identification of such disruptions are not justified, because they do not lead to a higher level of efficiency in the entire supply chain.

It is rather difficult to identify the transmitted disruptions caused by a risk factor which directly affects a larger number of companies. In particular, there are three situations significant for the identification of the "rippling effect", namely:

- the effects of the direct impact of a risk factor differ from the disruptions in the "rippling effect" (transmitted indirectly from other firms);
- the "rippling effect" occurred among companies in a supply chain operating in different parts of the world;
- the strength of disruptions in the "rippling effect" is noticeably higher than the same effects caused by the direct impact of a risk factor.

The effects of the direct impact of a risk factor in individual companies may differ from the disruptions caused by this factor transmitted to other firms in a supply chain. The ability to identify the "rippling effect" in this situation is illustrated in Figure 4.

As depicted in Figure 4, the risk of a flood, which negatively affects a supply chain operating in a particular region, may be a good example. The

direct impact of this factor resulted in a damage to the infrastructure, so that the supplier failed to fulfill the previously agreed date of the contract for a supply of raw material to the manufacturer. Although the latter one was also affected by the negative effects of a direct exposure to the risk, the failure to meet the date of delivery was more destructive for the manufacturer. The indirect impact of disruptions caused by an exogenous risk factor at the supplier stopped the production process, which in turn may lead to disruptions with the customers of the manufacturer. Thus, it is easier to distinguish between the direct and indirect impacts of disruptions, if the disruption transmitted from one company to another is different compared to the effect caused by the direct impact of a risk factor.

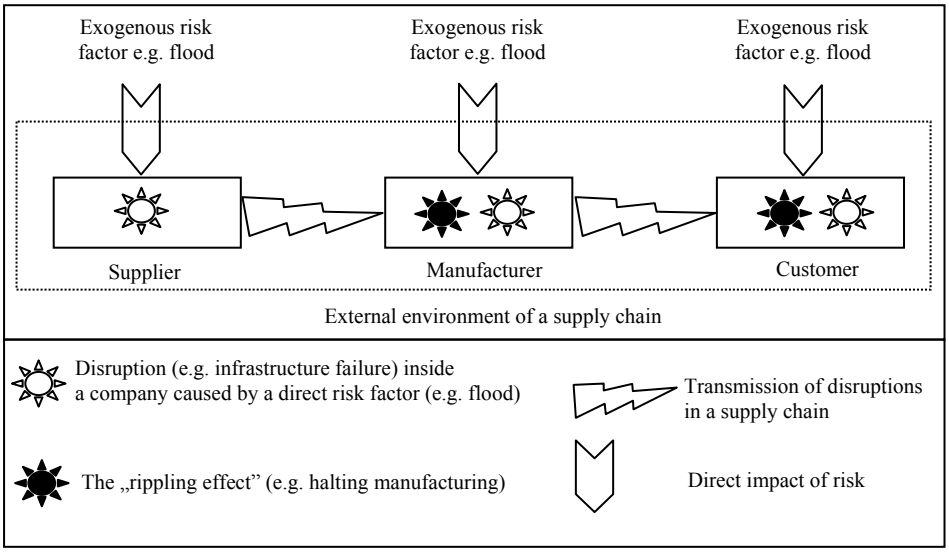

Figure 4. Identification of the effects caused by the direct impact of a risk factor and disruptions in the "rippling effect"

As depicted in Figure 5, amplified disruptions caused by risk factors may be transmitted from one company to another in a supply chain operating in different parts of the world. In such a situation, only a certain number of firms in this supply chain are exposed to the direct impact of the same risk factor. The disruption caused by a risk factor in a company operating in a particular region is transmitted to other firms in other parts of the world. The premise of such a situation is generally the local extent of the impact of such risk factors. It refers primarily to natural disasters, political factors, etc. For example, the earthquake and tsunami which struck the northern part of Japan in the first half of 2011, led to a deterioration of production in the plants located in that specific part of the country. The disruptions (halting

production) induced by exogenous risk factors (earthquake and tsunami) in the chain companies operating in Japan were transmitted to companies in other parts of the world, primarily in the United States and Europe.

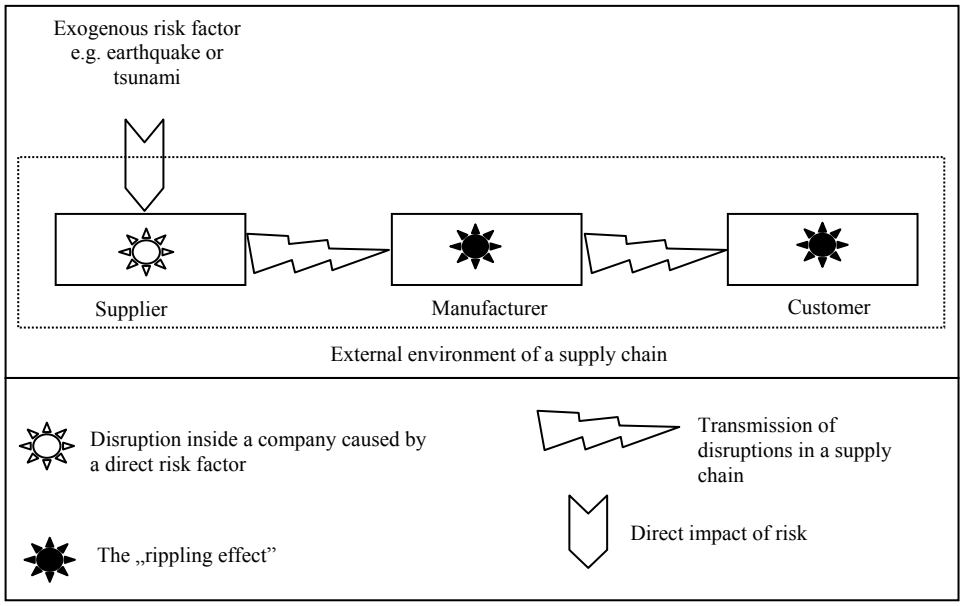

Figure 5. Identification of the "rippling effect" occurring among companies in a supply chain operating in different parts of the world

The "rippling effect" caused by the earthquake and tsunami in Japan might be observed in the supply chains of automotive, electronics and aviation industries. For example, the Peugeot-Citroen supply chain reported difficulties in production of some types of diesel engine, due to the lack of electronic components that had been produced by Japanese plants located in the affected areas. Similarly, the American division of the General Motors supply chain was forced to stop the production of cars in one of its factories located in the United States. GM Assembly plants in South Korea withdrew from the production of vehicles in overtime, as they were impacted by the shortage of car parts from Japan (Wyborcza.biz, 2011).

Table 1 presents the ability to identify the "rippling effect" caused by a specific risk factor in terms of its range of impact and the similarity of disruptions caused by the direct and indirect effects of risk.

As Table 1 shows, it might be impossible to identify the "rippling effect" caused by a global risk factor, affecting all companies in a supply chain, and when the similarity of the disruptions caused by the direct and indirect effects is high.

Table 1

Identification of the "rippling effect" in terms of the range of impact and similarity of disruptions caused by the direct and indirect effects of risk

Range of the impact in a supply chain	**Similarity of disruptions caused by the direct and indirect effects**	
	High	**Low**
Global	Impossible	Difficult
Local	Difficult	Relatively easy

As depicted in Table 1, the ability to identify the "rippling effect" might be difficult in two situations, namely:

- if the similarity of disruptions caused by the direct and indirect impacts of a risk factor is small, while the extent of its impact on a supply chain is global;
- if the similarity of disruptions caused by the direct and indirect impacts of a risk factor is high, while the extent of its impact on a supply chain is local.

It is relatively easy to identify the "rippling effect' when the extent of disruption is local, and while there is little similarity between the effects caused by direct and indirect risk factors. Additionally, there is a higher probability to identify the "rippling effect" caused by a specific risk factor when the strength of transmitted disruption from one company to another is noticeably higher than the same effects caused by the direct impact of this risk factor.

4. Dilemmas to identify "the rippling effect" in terms of exogenous and endogenous risk factors

The determinants of identification of the "rippling effect" have been illustrated in Figure 6. The arrow in Figure 6 begins at the corner of the rectangular, which indicates the global impact of disruptions (affecting all supply chain members), high similarity of the effects caused by direct and indirect impacts and low strength of disruptions in the "rippling effect". On the other hand, the arrowhead goes to the opposite corner of the rectangular, which indicates the local effect of disruptions (affecting only selected supply chain members), high differentiation of the effects caused by direct and indirect impacts and high strength of disruptions in the "rippling effect". Under such circumstances the identification of the "rippling effect" is relatively the easiest.

The above considerations show that the ability to read the "rippling effect" may differ depending on the exogenous and endogenous nature of risk factors.

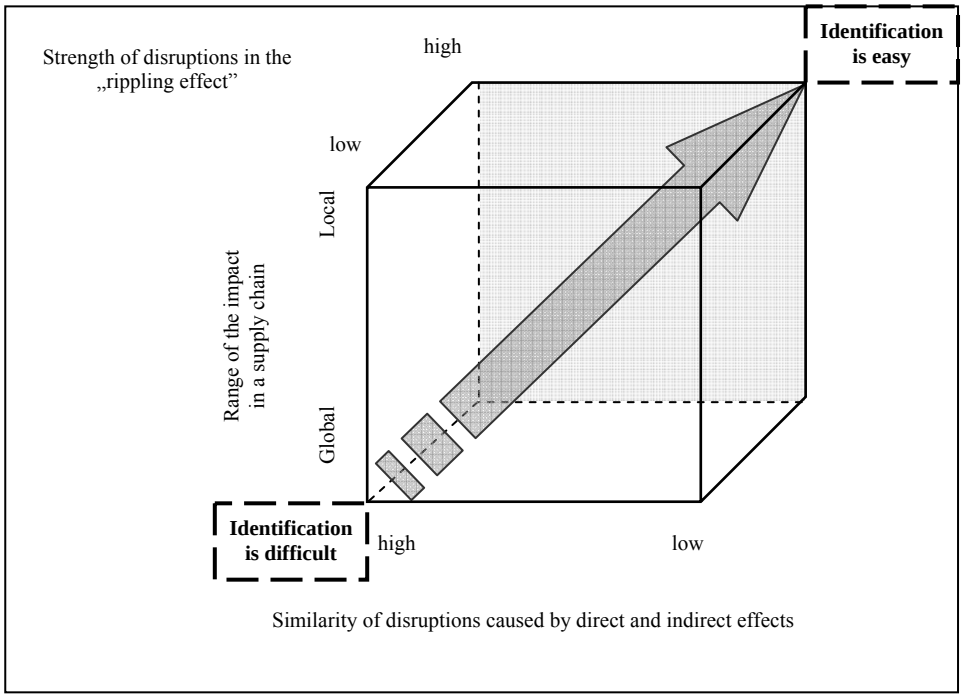

Figure 6. Determinants of identification of the "rippling effect" in the transmission of disruptions in a supply chain

The observation of the "rippling effect" caused by an exogenous risk factor might be relatively difficult as it requires considering environmental conditions and the specificity of a supply chain. It is worth noting that all companies operating in a particular region are exposed to the direct effect of a risk factor. Therefore, similar effects caused by the direct and indirect impacts of these risk factors can often obscure the phenomenon of the "rippling effect". The tendency is sustained when the strength of disruptions in the "rippling effect" caused by the factor is low. This may partially explain why managers often have problems with the identification of the "rippling effect" caused by exogenous risk factors.

On the other hand, endogenous risk factors are rooted in a specific company or the relationship between them, hence the direct impact of their negative effects is generally not applicable to all firms in a supply chain. The disruptions caused by endogenous risk factors are not common for a greater number of companies operating in a particular supply chain.

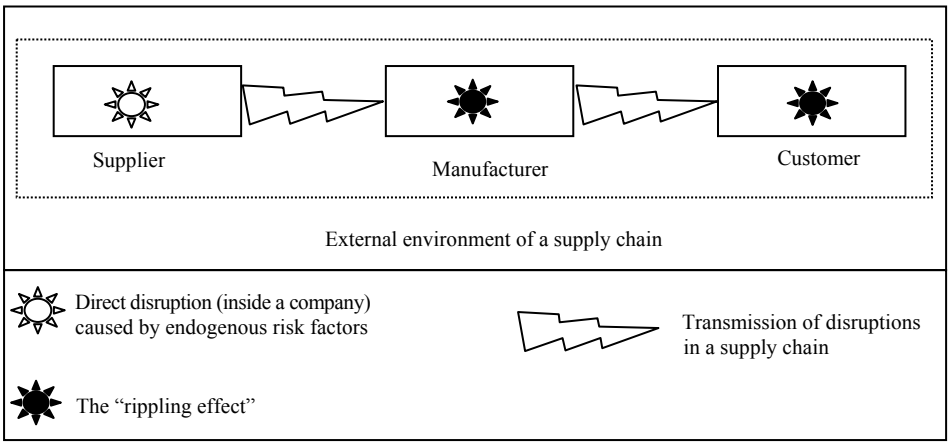

Figure 7. Identification of the "rippling effect" occurring among companies in a supply chain caused by an endogenous risk factor

The above mentioned argumentation allows to conclude that the "rippling effect" caused by endogenous risk factors is generally easier to identify than if it is originated from exogenous risk factors. The disruptions caused by endogenous factors are in fact characteristic for a particular group of companies in a supply chain, or result from the relationships between these firms – Figure 7. However, one ought to remember that sometimes it is difficult to distinguish the risk factors which cause particular disruptions. In general, at the same time there might be many different and interrelated risk factors, which are collectively perceived as the primary source of the "rippling effect" in a supply chain.

5. Future directions and further research

Apart from providing some insights into the contribution of identification of the "rippling effect" in a supply chain, the article also highlights the potential areas of future research.

The natural continuation of the issues considered in the article is to define the ways of measurement of the "rippling effect" enabling to make cross-sectoral and international comparisons of disruptions amplified in the transmission.

Another important element requiring investigation is the analysis of major determinants of the "rippling effect" in supply chains. Collaboration between companies seems to be the one of the most important bases for a transmission of amplified disruptions in supply chains. It may be assumed that the more intense relationships among the supply chain partners, the larger chance for the "rippling effect". Therefore, it would be interesting to investigate how collaboration

between companies contributes to the transmission of amplified disruptions in a supply chain. This analysis might also reveal the managerial methods and instruments mitigating the strength of transmitted disruptions. The study should define the appropriate attitude of companies towards the phenomenon of the "rippling effect" and indicate exemplary strategies preventing from the negative effects of disruptions transmitted along a supply chain.

Acknowledgements

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MARKETING IN THE ACTIVITIES OF LOGISTICS SERVICE PROVIDERS – SELECTED DIRECT SURVEY RESULTS

Introduction

Logistics service providers (LSP) run their activities in extremely competitive environment. As a result of more and more demanding requirements of the clients, the customized service with an added value has become the foundation of their activity. However, in a multitude of cases the activities of operators merge and coincide (Jeszka, 2009, p. 68). Many of them display total substitutability with regard to the offers of competitive operators (Hanus, Kempny et al., 2010, p. 18). The most experienced ones provide resources which could satisfy the needs of the most demanding customers, regardless of the type of branch, place, and role in the supply chain. Moreover, a considerable number of operators declare the fulfilment of comparable standards of service. This convergence increases the risk of selection of a competitive offer (Świtała, 2012, p. 59), especially as the quality of the service is considered the key determinant of purchase decisions, which, in turn, motivates the industry to search for new sources of market advantage, in particular opportunities to be distinguished from the actions of the competition. In other words, the further market success of LSPs will be more determined by efficient marketing and the role it will play in providing clients with the desired value.

1. Business marketing activity – theoretical grounds

Market changes have been accompanied by a growing interest in marketing activity for many years (Kotler, Kartajaya, et al., 2010, p. 41). In the modern model of management, marketing plays a strategic role. It is a way of perceiving the market reality, and an action whose aim is to meet the needs and satisfy the customers. In order to effectively respond to the increasing competition and the growing requirements of customers, the companies use relational marketing tools. Particular attention is paid to strengthening the partnership, while aiming at building long-term, profitable and based on mutual trust relation. Very often, the implementation of customer-focused strategy is accompanied by a need to reorganize business processes. According to D. Szostek (2012, p. 2), the decreasing predictability of market environment motivates companies to modify marketing itself. In economic practice it means the necessity to modify the company business structure (Homburg, Workman et al., 2000, p. 459). The key matter is to create a unit responsible for the coordination of marketing activities, including – activities related to the sale and customer service. Studies indicate that company market orientation largely depends on the manner of marketing organisation as well as its contribution to the management strategy (Verhoef, Leeflang, 2009,

p. 14; Engel, Brettel, 2011, p. 74-75). S. Ślusarczyk (2009, p. 9) implies that nowadays marketing has become too important to be treated in terms of an individual function of a company. However, T. Kramer (2004, p. 25) considers systematic market data acquisition to be an important manifestation of marketing orientation of companies.

2. Methodology and the research attempt characteristics

The fundamental purpose of the study is the attempt to evaluate selected aspects of marketing activity of logistics service providers*. The study focused on determining: the place of marketing in the organizational structure; the manner of organizing marketing services, the respondents' attitude towards the market research and the share of expenditures on marketing in the total expenditure. The undertaken research question was carried out on the basis of direct studies conducted with the use of online electronic surveys during the period from September to November 2011. The survey questionnaire consisted mainly of closed-ended dichotomous and cafeteria questions**. In the case of questions about expenses the answers were to comply with the information referred to in marketing or sales plans regarding the year 2011. The majority of respondents provided details regarding that issue.

In consideration of the limited financial and time possibilities, the studies based on purposive sampling method were to concern a group of 100 companies***. The sample selected included entities representing strategic groups of transport and logistics branch****. The questionnaire was addressed to a sample of 1046 companies; 107 entities responded*****.

* Note that the current studies carried out in the domestic market have not referred to transport and logistics branch (such as: Szostek, 2012; Gieracz, 2009).

** A filtering method was also used in a questionnaire. The questions about: the type of organizational structures, the motifs for TSL market and marketing budget research, were answered by a purposefully selected group of respondents.

*** Literature on market and marketing research assumes that any regional studies or studies of a company involved in specialised activity should require the use of a sample whose minimum size exceeds 50 (Churchill, 2002, p. 562). Purposive selection of a sample consists in the selection of entities entered into the sample by the researcher on the basis of the knowledge of the population under study (Szreder, 2010, p. 50).

**** The structure of domestic transport and logistics market divides into the following strategic groups: logistics operators, courier companies, road and rail freight and shipping companies, small freight car carriers and road freight forwarders (Rydzkowski, 2011, p. 68-70).

***** The basic source of data concerning the domestic transport and logistics market is the annual transport and logistics ranking published in a supplement on transport and logistics to Rzeczpospolita daily. In 2012 the online questionnaire was filled in by 61 transport and logistics companies (Brdulak, 2012, p. 26-27).

Characterizing the range of services delivered, the respondents answered multiple-choice questions. They mostly pointed to the services of transport, freight forwarding, and storage (Figure 1). Nearly half of the companies offer solutions of supply chain management and contractual work. Over 40% process the customs clearance. Many of the companies offer the VAS services related to the reverse logistics, cross docking and co-manufacturing. Almost 18% of respondents declared the express parcels processing. The respondents also pointed to other services, e.g.: rail depots maintenance, multimodal transport, insurance, document management, customer service and financial or marketing services.

Road transport appeared to be the main source of income for more than 36% of the research participants. Almost every fourth company derives the largest income from freight forwarding, primarily from organizing the freight road transport (13%). Storage service and logistics services sale are business domains of 13% of the surveyed companies. 5% of companies specialize in postal and courier services, and 7% pointed to customer service and air transport. 3% of respondents declared that their main source of profit is the intermodal transport.

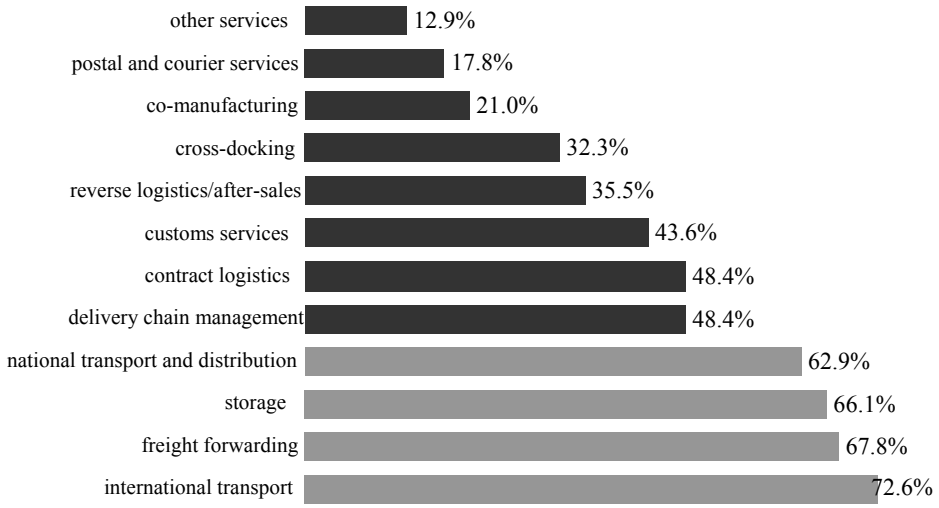

Figure 1. Range of the TSL services

The surveyed companies are primarily operators of an international range. More than 40% of respondents declare an activity in the European market, while 36% admitted to the global logistics services. Only every fifth participant limits the activity to the national market.

The study included companies with a diverse employment. Over 50% of the sample were medium and large enterprises employing up 250 people or more.

Every third researched subject proved to be a small company employing 50 people. The least numerous group turned out to be microenterprises.

The representatives of the companies participating in the study were mostly senior and middle management workers. Most respondents declared to be employed as directors of marketing, trading or selling. Besides them, the study involved workers employed in managerial positions (they were mostly managers of marketing, public relations, and sales) and finally the operational level staff (marketers, retailers, sales representatives, shippers).

3. The marketing organization in the tsl enterprises

The organizational structure of companies surveyed is dominated by the sales model. Frequently, companies have a simple sales department or retail department with auxiliary functions of marketing (Figure 2). These companies are in an early stage of marketing organization evolution (Niestrój, 1998, pp. 188-189). In this type of structures, marketing activity is identified with the sales activation. Even if the employer employs marketing staff, their responsibilities are very often connected to the implementation of sales plans, negotiating the sales terms and conditions, preparation of tenders, dispatching the information materials, etc. The research shows these are typical solutions for small and medium-sized businesses operating on the TSL market (transport, shipping, and logistics). It must be emphasised that the study results do not differ from the present perception of marketing in other companies operating in Poland. 50% entities under the study of 350 companies representing different economic sectors declared the fact of organisational structure marketing (Szostak, 2012, p. 6).

Large logistics companies are much more likely to have a marketing department (almost 58% of responses). Usually, there is a system in which the marketing and the sales work in parallel. Practically, effective realisation of business purposes requires their total integration as a part of implemented market strategy (Malshe, 2011, p. 45; Hughes, Bon et al., 2012, pp. 59-60). Respondents declare that the cooperation of marketing services with other departments work well (66% of responses)[*].

[*] However, a conflict of marketing purposes with the implementation of sales plans is present in many companies.

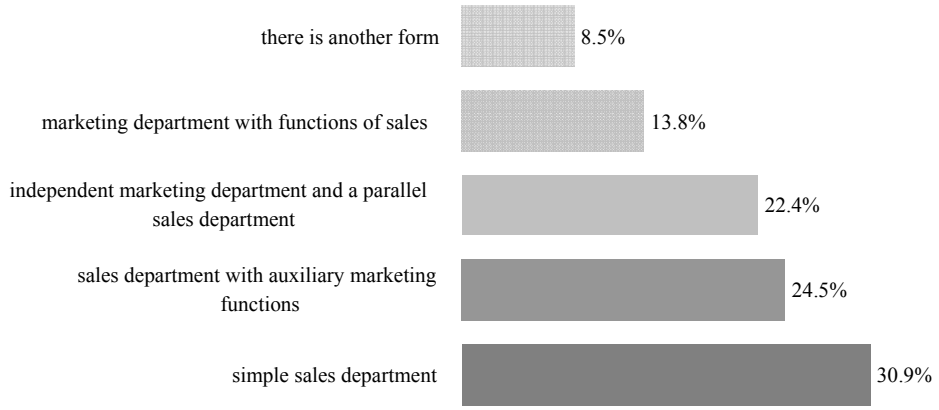

Figure 2. Marketing organization in the studied companies

The modern business model, where marketing integrates sales and customer service activities, is declared by every seventh participant of the study. He or she is employed by a large logistics company that operates on the global market.

In a survey, respondents also pointed to other forms of marketing organization. In the opinion of more than 8% – marketing and sales are dealt with by shippers or other operational staff.

The data show that the TSL sector companies apply a functional structure of marketing, in which particular tasks (e.g. sales promotion, market research, advertising) are assigned to the appropriate subjects/job positions (Figure 3). The studies indicate that functional infrastructure provides favourable conditions to organise more effective marketing actions which would stand out against the competition. Nevertheless, the coordination of marketing and other areas of the company activity seem to become a significant problem (Moorman, Rust, 1999, p. 181).

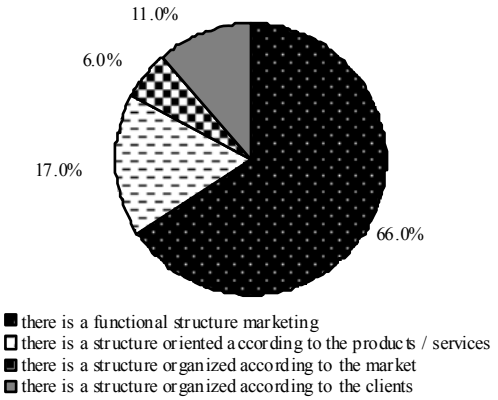

Figure 3. Types of organizational structures in the TSL industry

17% of companies surveyed work according to a structure that is a category of product – oriented (logistics services). This type of activities requires specialized job profiles responsible for marketing of services: courier, freight forwarding, main freight, storage, etc. Employees coordinate the overall marketing activities related to the offer assigned to them (Garbarski, 2011, p. 317). The next 17% indicated on a structure that is customers or markets – oriented. Research indicates that this is the way of operation of medium and large companies that adapt the marketing efforts to the serviced segments characteristics (market sectors).

The marketing management in the surveyed companies is centralized (Figure 4). Frequently, the marketing director or manager reports directly to the Management Board (47%) or the General Director (39%)[*]. Nearly 90% of respondents confirm the fact that there is only one central marketing service, which brings together all the marketing activities and processes[**]. This unit works for the entire organizational structure, both in the case of companies with one central branch, and companies with an extensive network of branch offices. Only a few participants pointed to the two-level model of marketing, in which the basic tasks are processed by the headquarters, and others – in branches/sections. These respondents appeared to be the employees of large companies offering global and comprehensive logistics service. An equally rarely used solution is a decentralized model, in which marketing decisions are made by the regional managers.

[*] In 11% of the surveyed companies, a sales director deals with the assessment and control marketing.

[**] According to A. Laing and L. McKee (2000, p. 577), contemporary companies, in particular international ones, decide on marketing centralisation within their structures more and more rarely.

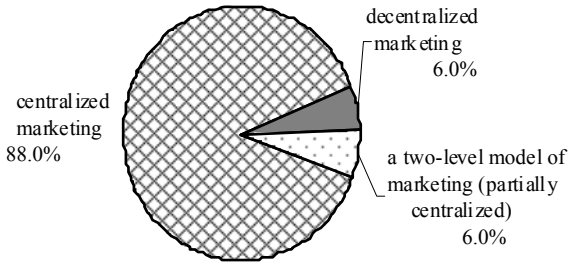

Figure 4. Marketing placement in the structure of the studied companies

The respondents declare that, most commonly, 1-2 people are employed in the marketing cells (47%). In 30% of the analysed cases, the marketing department consisted of 3-4 employees, and in 23% – of 5 or more persons. According to the data, the number of employees is determined by the size of the enterprise. The more developed was the organizational structure of a firm the more employees were responsible for its marketing activities. In the case of large companies (employing over 250 people with annual revenue exceeding 500 million pln) the employment in the marketing was of 8, 12 or even 15 people.

Currently, the leading logistics operators offer a number of varied positions related to the marketing and sales – from marketing director or manager, through sales manager, logistics solutions sales specialist to a marketing and sales specialist, a communication and CSR specialist, a marketing and promotion manager, and finally key account manager.

4. Marketing role in the tsl enterprises

Among the surveyed companies, marketing is treated as a support of the sales process (Figure 5). Frequently, the activities of sales support integrate the direct marketing tools and activate sales forces in the whole supported market to cooperate (Nawrat, 2004, p. 31). This type programs include: ATL instruments, telemarketing, mailings, e-mailing, and also various image-building campaigns carried out during sports events, cultural events, trade fairs and logistics conferences[*].

[*] Their main objective, however, is to improve the trade indicators.

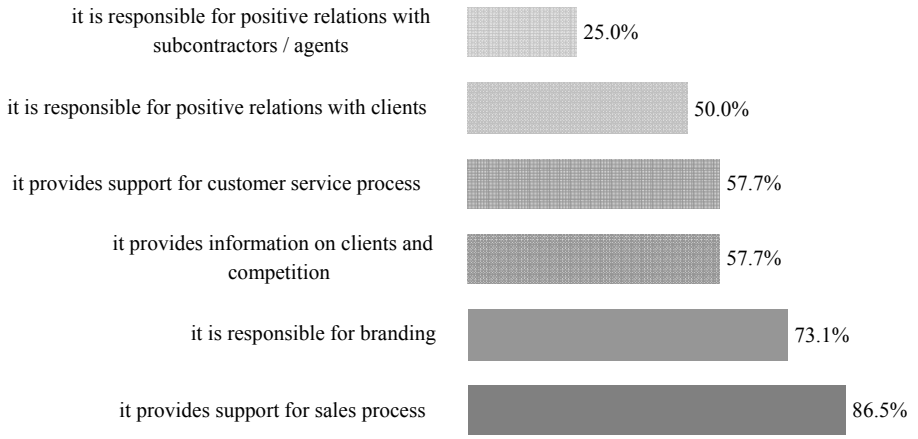

Figure 5. The role of marketing in the TSL enterprises

In most companies, the role of marketing in the process of customer service is noticed, but only every second respondent pays attention to the need of building relations with marketing tools. It should be emphasized that the TSL market is an area where a relations marketing has a wide range of applications, and the final result of the enterprise is affected by every customer (Witczak, ed., 2008, pp. 5-6). The experience of many companies shows that relations marketing is the most effective way of strengthening customers' loyalty. A key challenge is to skillfully manage partners relations, to explore new forms of cooperation and to take care of a faster, clearer and fuller information exchange (Maciąg, 2009, p. 49).

The results show that 75% of respondents do not see the role of marketing in building relations with business partners (agents). Over 70% believe that marketing is responsible for the company's "reputation" in the market. Most, however, do not notice the impact of partnership on image shaping. From this perspective, the aim of marketing is the promotion of partnership agreements with an additional benefits and integration of activities of mix marketing within the SCM and CRM strategy. The market position improvement is also possible through collaboration with the leaders of intralogistics solutions, the well known suppliers of IT software, the leading developers of storage space, or as a specialized subcontractor of 4PL or 5PL operators.

The respondents also declare that the role of marketing is to gain information on the market situation. However, they admit (over 60%) that this type of research is rarely carried out or it is not of managers interest at all (see Figure 6). The study results indicate that transport and logistics branch managers, as well

as other entrepreneurs involved in their business activities on domestic market, do not notice the usefulness or doubt the functionality of research projects*. It should be emphasized that the low efficiency of research (due to poor quality of research projects, misinterpretation of data or customers' dishonest declarations) and the lack of estimation of relation between the expenditure and the value of the company, are the most common allegations against marketing (Kozielski, 2009, p. 36). Only 38% of respondents admit to systematic market research. Usually, they are the employees of medium and large enterprises (> 70%) with a separate marketing department (> 50%).

An analysis of customers preferences and satisfaction and an evaluation the logistics services standards are the most common reasons to carry out marketing research. As pointed out by D. Kempny (2010, p. 10), the research on purchasing behavior and the market standards are one of the main methods of tracking changes in logistics service. A cognition of competition's behaviour appeared to be an important research task. 50% of respondents admit to monitor the market activity of their rivals. Every third surveyed company analyzes its market position and examines the level of logistics services price differentials. Less popular occurred to be the research on: customers' loyalty (> 28%), market dynamics (> 25%) and customer response to the news on the market (> 21%). The respondents were least likely to admit to examining the effectiveness of marketing programs (< 10%).

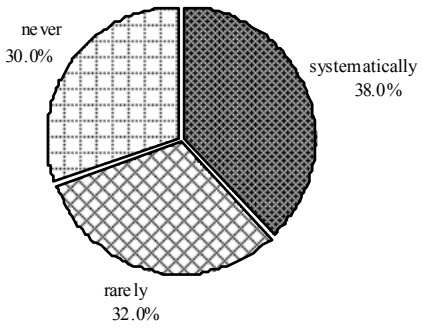

Figure 6. Frequency of researching the market by the TSL enterprises

Most often, marketing departments have a small budget (Figure 7). In the opinion of more than 38% of respondents, the share of marketing expenditure in

* The results of the study conducted by D. Szostak (2012, p. 7) indicate that more than 70% companies (production, commercial, service companies) do not conduct or commission marketing studies.

the total expenditure stands at 1-2%. In 18% of cases, the marketing activity accounted for 3%-4% of total expenditure. Higher expenditures on marketing were declared by only 16% of the survey participants (marketing consumes from 5% to 10% of the company budget). Although the majority of companies surveyed have an annual marketing plan, more than ¼ of the respondents did not answer the question about the marketing expenses.

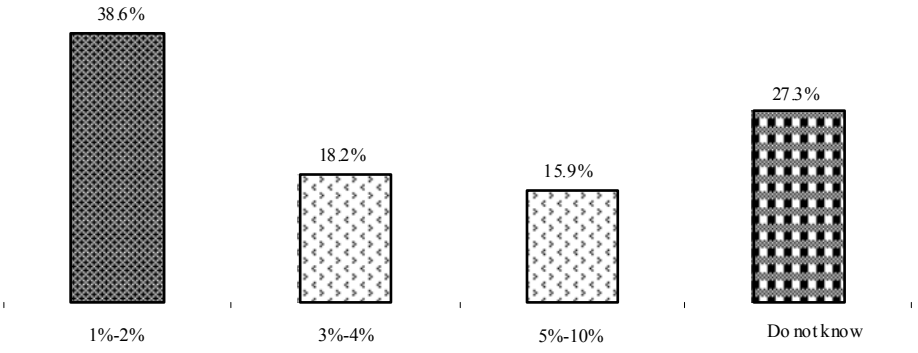

Figure 7. Participation of marketing expenses in the total expenditure of the surveyed companies (annually)

A difficult for the industry period of a downturn and the accompanying need of costs reduction, did not negatively affect the operation of most marketing departments. Over ⅓ of respondents declared that in recent years the marketing budget remained unchanged. A large group of enterprises financed a marketing and used the crisis to emphasize its presence in the market (> 33%). Only 13% of the surveyed companies reduced marketing costs, where less than 9% – only slightly. The results show that the decisions to reduce the mentioned costs were taken mainly in the micro and small enterprises. Large companies often claimed to increase the marketing budget (> 47%).

The insecure economic situation and the consequent threat of losing customers, encourage the TSL companies to increase spending on marketing*. More than 46% of respondents expect that, within the next few years, the level of investment in the development of marketing will be increased, out of which 13% believe that marketing departments will operate on a much higher capital than at present (Figure 8).

* It is assumed that in 2012, the sales growth dynamics in the market of logistics services will decrease by 4 per cent points, compared to 2011 (Szreter, 2011, p. 102).

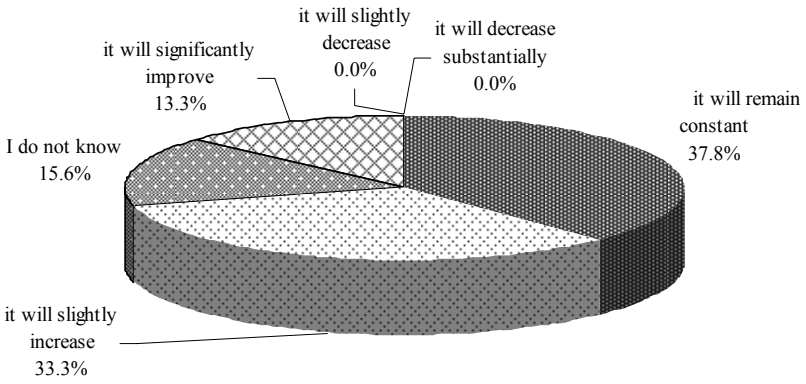

Figure 8. The respondents assumptions concerning the marketing budget for the following years

Almost 38% of respondents declare maintaining stable budget. No company plans a reduction in spending on marketing activities. Also in this case, the respondents employed in large companies with the income of more than 100 million pln were more optimistic in their responses.

Conclusions

According to the obtained results it can be noticed that marketing does not play a significant role in the enterprises of the TSL sector. It is regarded as an auxiliary function and sales support instrument, which confirms the weak marketing orientation of LSPs. The industry is based on the sales model without a clearly outlined marketing concept. This is a typical way of operating by not only small but also medium-sized transport and logistics companies. Large LSPs often have a separate marketing cell. Usually the marketing activities are organized based on the simplest criterion of a function. The marketing managing is done centrally, regardless to the size and scale of activity of the surveyed companies. A process approach is rarely present. The researched companies are not interested in the systematic acquisition of market information. The effectiveness of the marketing campaigns is studied by less than 10% of respondents. Only every second company recognizes the impact of marketing on building positive relations with customers. The role of marketing in managing the relations with suppliers is not noticed either (including the carriers). As a matter of fact, the branch situation does not differ from the condition in other economic sectors.

The low expenditure on marketing activities can be considered as the primary obstacle in the marketing development. However, it should be emphasized that a large group of respondents sees the need for intensification of marketing activity. Most likely, the expected decline in demand for logistics services as well as prevailing market nervousness, encourage businesses to invest more in marketing. For the near future, the examined firms are interested in improving their market positions, distinction of their offer from the competition, and, in particular, an increase in the customers' loyalty.

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BUSINESS COOPERATION OF LOGISTICS COMPANIES WITH SMALL AND MEDIUM ENTERPRISES – RESEARCH REPORT

Introduction

The financial, technical, and organizational capabilities for small and medium enterprises are much smaller than those available to larger companies. The continuous increase in the level of competition, instability and the dynamics of the market situation complicate the activities of these firms, making it difficult for them to accomplish their own purposes (Zowada, 2011, p. 169). Faced with such conditions for the functioning, small and medium-sized businesses need to act quickly, concentrating its efforts on selected areas of activity, at the same time acquiring skills in the rest of the market. These are the conditions against which the concept of outsourcing, defined as the ability to use independent external entities as providers of goods and services instead of having to develop these areas of activity within the company (Perechuda, 2000, p. 116), becomes an interesting alternative to the other methods of achieving a competitive advantage. Logistics, therefore, like many other features implemented in the enterprise, can provide its core competency or be contracted out (to companies offering various types of logistics services).

This paper provides a summary of the pilot study on SME cooperation with the supply side of the logistics services market. The study was conducted among small and medium-sized companies (production, trade and service) operating within the voivodeship of Silesia, of which over 89% employed less than 49 employees, the annual sales of these companies in most cases do not exceed 2 millions, and the range of their activities was mostly regional or national (total 69%) rather than European – there were nine companies in this group[*]. The cognitive purpose of the study, set by the author itself, was to determine the mutual relationships between these two groups of companies as well as an attempt to verify the hypothesis about the necessity of cooperation of small and medium-sized businesses with companies that provide various types of logistics services.

1. Cooperation conditions and the choice of a logistic company

Logistics service provider is an external supplier that performs either all or a part of the company's logistics function (Kisperska-Moroń, Krzyżaniak, ed. 2009, p. 218). Such a broad approach to the concept of logistics service provider can cover both the companies providing simple services such as transport or

[*] The pilot study was conducted between September and November 2011. The participants filled out an electronic on-line questionnaire. An invitation was sent to 465 small and medium enterprises from Silesia. The degree of the sample implementation was approximately 11%. 49 responses were received.

storage, as well as larger companies, the so-called logistics operators (3PL) offering complex services often involving the acquisition of all customer's tasks and logistics processes. In a similar manner the meaning of the logistics service provider was interpreted by the respondents in the study (in most cases they were either the owners of the enterprises or persons who are in the management positions – in total these two groups accounted for more than 75% of respondents). A question about the fact of the use of logistics services was therefore understood as a question of the interest in the services both large logistics operators, as well as small bus companies providing basic services in the field of transport. In this case, the gathered responses confirm the author's assumption that the majority of small and medium-sized businesses use, to a smaller or greater extent, different types of logistics services provided by outside companies – about 84% of companies surveyed claimed to use the services of logistics companies. However, it arises the question about the reasons for such cooperation, its scope and nature as well as the interaction between the client and the service provider.

In this context, a question concerning the number of logistics companies that small and medium-sized enterprises cooperate with at the same time, seemed interesting. The responses helped to show the mutual relationship between logistics service providers and small or medium-sized companies – more than 60% of respondents work with only one or two companies providing logistics services (Figure 1). This may indicate a partnership relationship between businesses, or be the result of fierce competition between logistics companies for even such a small customer like a company in the SME sector. On the other hand, the answers of the respondents, who use the services of more than two logistics companies at the same time, were motivated by a desire for greater flexibility and independence of one service provider, or resulted directly from the reported needs of customers.

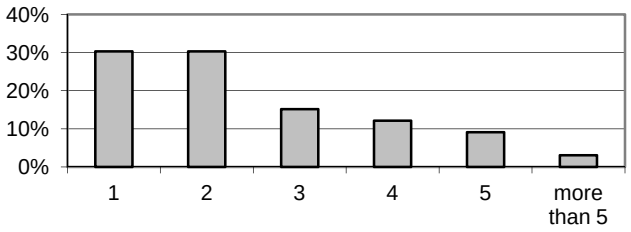

Figure 1. The amount of logistics companies that the SMEs cooperate with at the same time

Source: Own study.

At this point there is another question, namely, the preference of small and medium-sized enterprises for logistics partner. Most of the surveyed companies mentioned a large logistics company (over 45%). But a surprise as well as a positive prognosis for small and medium-sized logistics service providers development is the fact that to a similar group of respondents (20%) the size of logistics company either does not matter or, it is actually a small or medium logistics company that is a preferred partner. However, among the most often mentioned businesses, which work with SMEs, there are a lot of Polish companies in the world's leading logistics market. This group includes such well-known brands as: DHL, UPS, DPD, GLS, TNT, and Schenker or our native Siódemka (Figure 2).

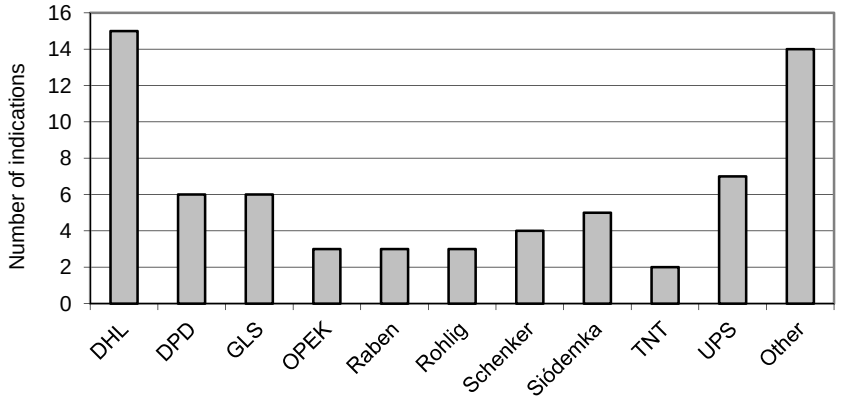

Figure 2. Logistics companies the most often indicated by the respondents

Source: Own study.

The last aspect, which should be noted, are the conditions which motivated the respondents when they made decisions regarding outsourcing of logistics services and specific criteria for choosing a logistics partner.

In the first case, the main reason appeared to be the desire to improve customer service – almost half of respondents believe so, an increase of company's flexibility and willingness to focus on core business – 39% and 42% of respondents thought so (Figure 3). Undoubtedly, these responses are part of a general tendency on creating companies that are flexible, able to adapt to changing market conditions and, at the same time, focus their efforts on selected areas of activity.

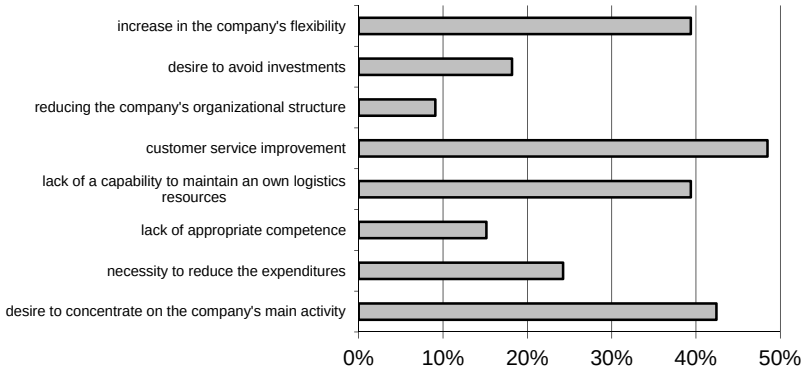

Figure 3. Main reasons for using the logistics companies services by the SMEs

Source: Own study.

On the other hand, no doubt especially for the SME sector, important for decisions regarding the use of outsourcing, is the issue of inability to maintain their own logistics (39% responses), and thus the lack of appropriate competence. In many cases, using external service of a logistics company is a necessity, which in the long run, however, as respondents pointed out, results in logistics customer service improvement.

What then determines the choice of a particular logistic company to cooperate with? These issues are presented in Figure 4.

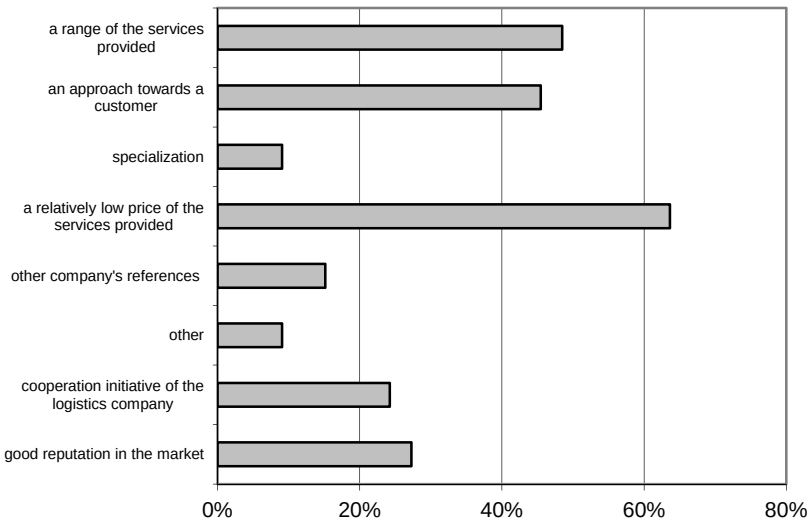

Figure 4. The criteria for the choice of a logistics service provider

Source: Own study.

Among the factors that are of a paramount importance when making the choice of a specific logistics company, the most frequent answers are: a relatively low price of services – such response was provided by 63% of respondents, the range of services and the approach of a service provider to the customer. Importantly, these are the factors that determined the very fact of selecting a particular company, and thus the items that respondents were able to take into consideration before collaboration with a certain logistics company. However, this does not mean that these elements, when assessing the cooperation carried out after a certain time after its establishment, will continue to be major factors, which at the same time does not exclude itself.

2. The subject and scope of cooperation

On the axis of "own solutions" – "outsourcing" there are many possible solutions. Decisions about outsourcing may be taken in relation to particular processes, and the development of cooperation can take place according to the gathered experience and to the increase in trust while dealing with logistics partner (Barszczewski, 2005, p. 27). When making decisions about logistics outsourcing, it must be remembered that the logistical problems of small and medium enterprises do not differ from the problems that exist in the field of logistics among larger manufacturing, commercial or service providing companies (Piniecki, 2006, p. 156). Despite the small scale of economic activities and simple logistics processes, in small and medium-sized businesses all essential components of these processes are present, namely: the real processes of flow, information processes and cash flows (Skowronek, Sarjusz-Wolski, 2008, p. 33). The question therefore arises about the scope, frequency and repetition of outsourced logistics activities in terms of cooperation between a small or medium sized enterprise and a logistics service provider. The results of studies on this issue are presented in table 1.

Table 1

The services of logistics companies used by the SMEs.

Type of service/frequency	Do not use	Less often than once a month	Once a month	Few times a month	Once a week	Few times a week	On a daily basis
FTL transportation	28.58%	19.05%	14.29%	28.58%	0%	4.77%	4.77%
Groupage transportation	14.29%	9.53%	9.53%	19.05%	4.77%	19.05%	23.81%
Courier service	3.13%	3.13%	3.13%	21.88%	6.25%	37.5%	25%
Storage	70.59%	0%	5.89%	5.89%	0%	0%	17.65%
Completion, packing, labelling	62.5%	6.25%	0%	6.25%	0%	6.25%	18.75%
Special (e.g. ADR service)	93.34%	0%	0%	6.67%	0%	0%	0%

Source: Own study.

Examination of the results indicates that in terms of cooperation of small and medium-sized enterprises with logistics companies, the first group uses transport and courier services with varying frequency. These trends are confirmed by the respondents' answers in the area of logistics, which generates the highest costs in their company – more than 40% of the responses concerned the costs associated with transport. This can be due to the fact that a small number of companies from the examined sector, is able to maintain extensive transport facilities enabling quick and relatively inexpensive service of their customers at relatively large distances. For this reason, as well as for the lack of expertise to enable the achievement of economies of scale, most small and medium-sized businesses decide on gaining the required competence in this area from the market.

A completion of the question regarding logistics services, which are used by the studied companies, was the question of the recurrence of orders passed to logistics companies. Answers to this question helped to determine the attractiveness of the surveyed companies to the companies providing logistics services. Undoubtedly, recurring and more routine orders (more than 78% of responses, most of which concern transport services) allow for a relatively continued income, with limited involvement of service providers in adapting to the individualized customer's needs. On the other hand, the order of an individual matter make in the big logistics firms a disproportionate involvement of sources in relation to the obtained results, what in contrary was indicated by respondents as an opportunity for small and medium-sized logistics companies.

The results show that the majority of logistics services that are used by the studied companies refer to the so-called basic services and thus are primarily related to transportation, and much less to storage. It should be noted that several respondents admitted to using so-called value-added services (including packing, completing, labelling), slightly more said they use the services associated with IT support in the field of logistics processes, while three companies outsourced the support service in logistics consultancy (including various types of training).

3. The cooperation course and assessment

The separation of a certain activity of the company may not be the aim in itself. Such decision must be justified from the point of view of the company's adopted strategy and serve its implementation (Ciesielski, 2003, p. 135). A very important element becomes a feedback thanks to which the client – in our case a small or medium business, can and should continually analyse the course of cooperation with the logistics partner, and make the necessary adjustments if needed.

A positive surprise appeared to be the respondents' answers to the question, in which they were asked to assess the course of previous cooperation with the

company/logistics companies on a five-point scale. Most, over 63%, of small and medium-sized companies assessed it well, while one in four admitted that the cooperation with a company/logistics companies deserves the highest possible rating.

Importantly, almost every third respondent admitted that since the establishment of cooperation with the logistics company to date, the level of logistics services for its business has improved, or even greatly improved, while none of the respondents stated that the level of services offered by the logistics partner deteriorated – at worst it remained unchanged – almost 67% of responses. These results clearly indicate that the sector of small and medium-sized enterprises is located in the target customer group many logistics companies. To confirm this fact, it is worth noting that the cooperation of more than half of small and medium-sized enterprises was based on long-term rather than short-term contracts. It should be noticed that respondents had the right to indicate several answers to question about formalizing cooperation with logistics partner and some of them admitted to have a long or short term contract, while the rest of the orders are executed in the context of normal market transactions.

Among the criteria which guided respondents evaluating cooperation with logistics companies, according to the author's earlier assumption, the quantitative factors and thus directly related to the financial side of such cooperation, resolve qualitative factors, which are passed directly to the level of logistic support for the final customers of small and medium-sized enterprises (Figure 5).

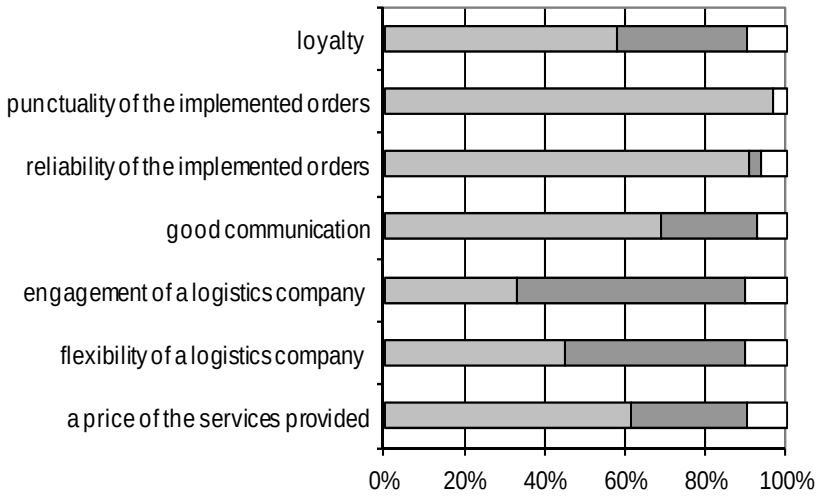

Figure 5. The evaluation criteria for logistics service providers.

Source: Own study.

Punctuality and reliability are the two main parameters determining the assessment of a particular logistics company. Among the open responses, predominated respondents' opinions that the punctual delivery of goods to customers is crucial and creates the image of the company in the environment. Elements that slightly yield to the factors directly related to the financial side of cooperation between small or medium enterprise and a logistics company are: partner's loyalty understood as a confidence in the implementation of each order under the previous agreement as well as a communication between these companies. Only 3% of the surveyed companies met a frequent refusal to comply with orders entrusted. Most respondents stated that this situation occurs either sporadically or not at all – more than half of the answers. This can indicate that small and medium enterprises (although usually smaller scale operations, and thus relatively small, compared to large-scale logistics companies' customers, scale of outsourced logistics processes) are in most cases regarded as important partners, which, due to their incomparably greater amount, each wishing to count on logistics market company should also seek.

Conclusions

Major logistical problems that can be met among small and medium-sized companies usually do not differ from the problems that occur in larger commercial, manufacturing or service companies. All decisions, including those concerning logistics have a common denominator, which is the criterion of rationality and efficiency. In this context, having adequate logistics competence, obtained from the market by working with various companies providing different types of logistics services, is increasingly common phenomenon in the small and medium enterprises sector.

There is a growing awareness of the logistics among the owners of companies in the studied sector. Logistics is not an another feature implemented in an enterprise, but an effective tool of competition. Increasing the flexibility and punctuality, and thus a rise of the level of customer logistics service is, according to owners and managers of small and medium-sized enterprises, an argument in favour of making cooperation with external logistics partner. According to almost half of the survey participants, logistics plays a very important role in the activities of small and medium enterprises, and for every fifth examined company it is the most important. It is worth noting that most of owners and managers of the surveyed companies, recognize that cooperation with logistics partner, though mostly due to the need, finally results in the enterprises deve-

lopment. Over 75% of the respondents in fact see a positive correlation between the development of their company and co-operation with the logistics company.

This study does not fulfil the undertaken subject. Exploring the problem of cooperation of small and medium-sized enterprises with logistics companies should be continued. According to the author, the economic importance of small and medium-sized enterprises is a demand to take this test.

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