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ANALYSIS AND ASSESSMENT OF DANGEROUS ITEMS FREIGHT ROAD TRANSPORT OUTSOURCING

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Abstract: *In the present highly competitive and dynamic market environment, businesses make an effort to be more flexible and reliable in meeting their customers' requirements. Therefore, suppliers strive to make a perfect delivery, whose achievement is significantly affected by transportation. That is why a number of businesses outsource transportation, which thus becomes one of the most frequently outsourced activities. However, apart from the obvious benefits of outsourcing, there are also some new problems connected with a different rate of cooperation and interconnection of partners on different levels of the supply chain. That is why the paper specifies, on the basis of an analysis and assessment of the transportation process in selected chemical industry enterprise, not only the advantages, but also the problems connected with outsourcing of dangerous items freight road transportation and proposes solutions to these problems.*

Key words: *transportation, transport, outsourcing, dangerous items*

1 INTRODUCTION

In the present highly competitive and dynamic market environment, suppliers endeavour to provide their customers with perfect delivery. It is defined by Christopher as delivered in time, completely, and faultlessly [1]. Achievement of such delivery is strongly related to transport. Transport costs account for the largest part of logistics costs [2]. In transport of dangerous substances, it is necessary to meet a number of legal regulations. Transport thus becomes one of the most frequently outsourced activities. Outsourcing can be a very effective strategy to increase operational performance, improve customer service, at the same time that minimizes capital investment, freeing up capital to other importatnt projects according to the company strategy that will increase revenue and profitability. However, when outsourcing is not performed in the right way, it can also decrease performance and hurt customer service, reducing company competitiveness [3]. Apart from the obvious benefits of outsourcing [4] it also brings some new problems and risks connected, among others, with a different rate of

cooperation and interconnection of partners on different levels of the supply chain, and this also depending on the type of product of area of business [5].

This paper aims, based on the outcomes of an analysis of the shipping process in a selected chemical industry company in the Czech Republic, to identify and specify the problems connected with outsourcing of shipment of dangerous items, to assess the process and to propose potential improvements.

Targeted literature search in scientific literature focused mainly on logistics services in shipment outsourcing, method of in-depth interview with managers in chosen company were used as research methods and sources.

2 THEORETICAL BACKGROUND

Transport and shipment are parts of supply chains. They are defined as a sequence of activities in integrated and mutually interconnected logistic chains, including activities connected with implementation of reverse flows, whose performance is necessary for fulfilment of the final customer's requirements in the required time, quantity, quality, and to the required place [2]. They can also be characterized as a sequence of steps adding the customer value [6]. The value delivered to customers affects their behaviour and, at the same time, it is the basis for creation of the competitive advantage and thus for strengthening the competitive position of companies on the market, which leads to increased profitability of the customers for the company. Therefore, the company should strive for its permanent growth [7], and pay more attention to innovations and building long-term relationships with customers [8]. An important role in this process is played by transport and shipment ensuring material flows of raw materials, semi-finished products in direction from the suppliers to their customers, and reversely directed flows including product returns, their service, recycling, and disposal.

A number of authors approach the problems of transport and shipment from different points of view. Transport is an intentional motion activity consisting in moving persons or tangible property by movement of means of transport along a transport road [6, 9]. Siroky adds that this movement can be performed using the own power or mediately [10]. The wider concept of transport also takes account of the time aspect and the customer value.

Shipment is the resulting effect of the moving (transport) process, the final change of overcoming space and time. In the wider concept, it is possible to understand it as the summary of all activities including the moving process itself and the services relating to it, i.e. loading, reloading, interim storage, customs procedures, insurance, etc. [6,9]. And thus shipment represents the final effect of transport, and it is determined by its starting and end points of the process of moving [10]. From the economic point of view, it is the process of implementation of the transport utility value [9].

Transport and shipping processes involve various entities. The main ones include carriers and forwarders. The other participants include forwarding and carried agents, co-called third parties [3], who are the connecting link between the carrier and the forwarders.

Carriers are often also the owners of the means of transport, or they can rent them. Public carriers offer their services to any forwarders requiring transport of products for published rates between specified places. Haulage contractors only provide transport services to a limited number of forwarders on the basis of specific contractual agreements. Novak divides carriers into contractors and actual carriers. Actual carrier physically transports the consignment or its part by themselves. What is most important for haulage contractors is the fact that they are a party to a contract of carriage, whether they physically conduct transport or not [9].

Carriers' customers are forwarders, mostly as recipients or consignors. So forwarders are consumers of transport or shipping services, owners of the tangible property [6, 9]. If forwarders are owners of a vehicle fleet and operate transport services for their own purposes, they are carriers at the same time [11].

2.1 SPECIFICS IN TRANSPORT OF DANGEROUS ITEMS

In the Czech Republic, dangerous chemical substances and preparations (hereinafter referred to as dangerous items) are often transported by road or in combination with rail transport. Dangerous items refer to substances representing serious risks for living organisms. They have toxic, carcinogenic or mutagenic effects, and they can cause fire and explosion with toxic products and burning has negative impacts on humans and the environment [11, 12]. Therefore, it is essential to respect the specific properties of these items and take any measures to prevent their leakage into the environment during transportation and handling. Dangerous items management is governed by Act No. 356/2003 Sb. on chemical substances and chemical preparations and on amendments to some acts. The act regulates, in compliance with the European Union law, the rights and obligations of corporate entities and natural persons running a business in classification and examination of dangerous properties, marking and packaging, launching or putting into circulation, in export and import, and in announcement and registration of chemical substances and preparation. In addition, it defines the competence of the administrative authorities in the process of ensuring protection of health and environment against the harmful effects of these substances and preparations (Act 356/2003Sb., Chapter I, §1).

To decrease the risks of carriage of dangerous items as much as possible, certain rules relating not only to road, but also to rail, air, and ship transport have been incorporated into domestic and international regulations. Domestic road transport is generally governed by Act No. 111/1994 Sb., on road transport, Decree No. 48/1998 Sb., which implements the act on road transport, and also Act No. 125/1997 Sb., on wastes [9]. International carriage of dangerous items by road is governed the European Agreement of ADR, which is regularly updated in two-year periods. The current regulation came into force on 1 January 2013 and it is effective in 48 mostly European countries. For more detailed characteristics of dangerous substances and preparations, see e.g. [13].

All participants in carriage of dangerous items are obliged to take adequate measures in accordance with the character and scope of foreseeable risks in the way to prevent occurrence of any damage or injuries or, as the case may be, to minimize their consequences. It is always essential to observe all the requirements based on the ADR agreement. The consignor is obliged to classify, pack, and mark any dangerous items, and prepare for carriage only such consignments that comply with the requirements of the ADR. In particular, the carrier is obliged to make sure that the means of transport is free of any evident defects and that it is properly equipped, and to make sure that the carriage is performed by trained drivers only. The recipient may not delay taking delivery of such items without cogent reasons. The other entities involved in such carriage have the obligations relating to the obligations of the above main carriage participants. An important role in the area of preventing risks connected with dangerous items is played by a safety advisor, whose job is to facilitate performance of these activities. To make sure that handling of dangerous items is a safe process, all of them have to be properly classified and marked. The sources of information about the dangerous items are the codes and identification numbers specified in the regulations for carriage of dangerous items. They mainly serve as a source of any other needed information about a chemical substance or preparation. They include the hazard identification number (so-called

Kemler code), UN-code, and ADR classification [11, 12]. Also, when packing, the substances have to be classified on the basis of their hazard class into one of the three packing groups on the basis of the amount of risk they pose [13].

It is obvious that handling and carriage of dangerous items is a highly specific process, and so it is dealt with by a limited range of outside companies – logistics services providers. A large number of enterprises seek cooperation of specialized third parties to perform these activities, which do not belong to their core business. And chemical industry enterprises mostly opt for outsourcing of transport, mainly for the reason of cost savings [8].

2.2 OUTSOURCING OF TRANSPORT OF DANGEROUS ITEMS

Outsourcing has experienced a worldwide significant rise since the 90's of last century. To arrange outsourced transport, it possible to make use of any rate of cooperation, from logistics service providers on 2PL level to 5PL level. The marking is according to the growing range of services offered by the providers and the related various rates of cooperation and interconnection of the partners [6, 9, 14].

2PL is the least interlinked system ensured by classical providers of forwarding, carriage, and warehousing services. It was mainly created for the reason of cost savings, and there is no closer relation between the client and the provider. Transport can also be outsourced together as a part of carriage within material flow management in individual links of a logistics chain in the form of 3PL, or as a part of integrated coordination of a material flow managed by 4PL or 5PL.

3PL providers provide individualized carriage, warehousing, and other logistics services, including giving information about consignments, or they also take over implementation of the entire logistics chain. They provide their services on the basis of long-term contracts, they have their own logistics infrastructure, and they have their share in the enhancement of customer services [6, 9, 14, 15]. The key contribution to common achievements is mutual communication, flexibility and openness [16].

In recent years a concept known as 4PL has emrged [15]. 4PL providers represent the closest form of partnership on the basis of mutual confidence. They take over complete optimization of the entire logistics chain using new technologies in the way to establish the smoothest possible process of creating the customer value [6, 9, 14, 15]. 5PL is then a purely virtual provider combining someone else's sources, technologies, and capacities. Their activities consist solely in the know-how area. In the literature, we can also meet the concept of a Lead Logistics Provider (LLP), where the whole external logistics system of the client's company is outsourced by a single logistics provider. This provider takes over analyzing, project management, implementation and management of logistics chains of the entire client's manufacturing plants, including mutual harmonization of the chains. They have their own logistics network and professional staff [6, 9, 14].

Carriage of dangerous items is specific. Therefore, chemical industry businesses have, when choosing the right provider, a smaller sphere of activity. It is essential for a business to analyze all pros and cons relating to outsourcing of transport. They have to decide to which provider they will delegate performance of this activity, what form of partnership it will be [17], whether they will choose only one or more service providers, and whether they will form a short-term or long-term partnership [6].

For a number of chemical industry businesses, it is the price what is the most important criterion for choosing a logistics service provider [18]. However, it should not be the only criterion in such a selection procedure. The other criteria can mainly include the

carrier's experience with transport of dangerous items, the quality of carriage, flexibility, and ability to observe the safety and environmental principles set by the business.

Some enterprises prefer carriers having the SQAS Certificate, i.e. the safety and quality assessment system, including health and environment protection, intended exclusively for logistics service providers. SQAS is a standard of the European Chemical Industry Council. The outcomes of a transport company's management system assessment performed by an independent evaluator are published on the web pages (www.sqas.org), and businesses choose carriers on the basis of this assessment [19].

If a chemical industry enterprise decides to use services of an external carrier, this does not mean that they get rid of all their obligations and responsibilities. It is still an obligation of the enterprise as the consignor to perform proper classification, packing, and marking of dangerous items, to conduct inspection of the means of transport in accordance with the ADR, to mark the vehicle properly after loading, including the identification number of the shipped substance and the level of its danger, to give the driver the transportation documents, i.e. a waybill with the designation, a UN number, a class and an ADR number, the number of items and their description, weight or volume, and written instructions for the driver for each kind or group of dangerous items in case of an accident. Only then it is possible to ship the dangerous items to the customer [12]. The external carrier is obliged to make sure that the drivers are properly trained in accordance with ADR and equipped with the ADR Driver Training Certificate. The carrier is also obliged to make sure that the vehicle carrying dangerous items is properly equipped in accordance with the ADR requirements, including the certificate of approval of the vehicle for carriage of dangerous items.

3 TRANSPORT ANALYSIS AND ASSESSMENT IN THE SELECTED CHEMICAL INDUSTRY ENTERPRISE

The selected enterprise is, above all, a leading European manufacturer of qualified chemistry with a long-time tradition. It supplies its products all around the Czech Republic and exports them abroad, mainly to European countries, Russia, Turkey, the USA, etc. As for its import of raw materials and semi-finished products, its important partners include India and China in particular. The items are delivered inland within one day, while deliveries abroad take between two and four days on average. Main results of analysis are summarized in Fig.1, in the next text more detail description is given.

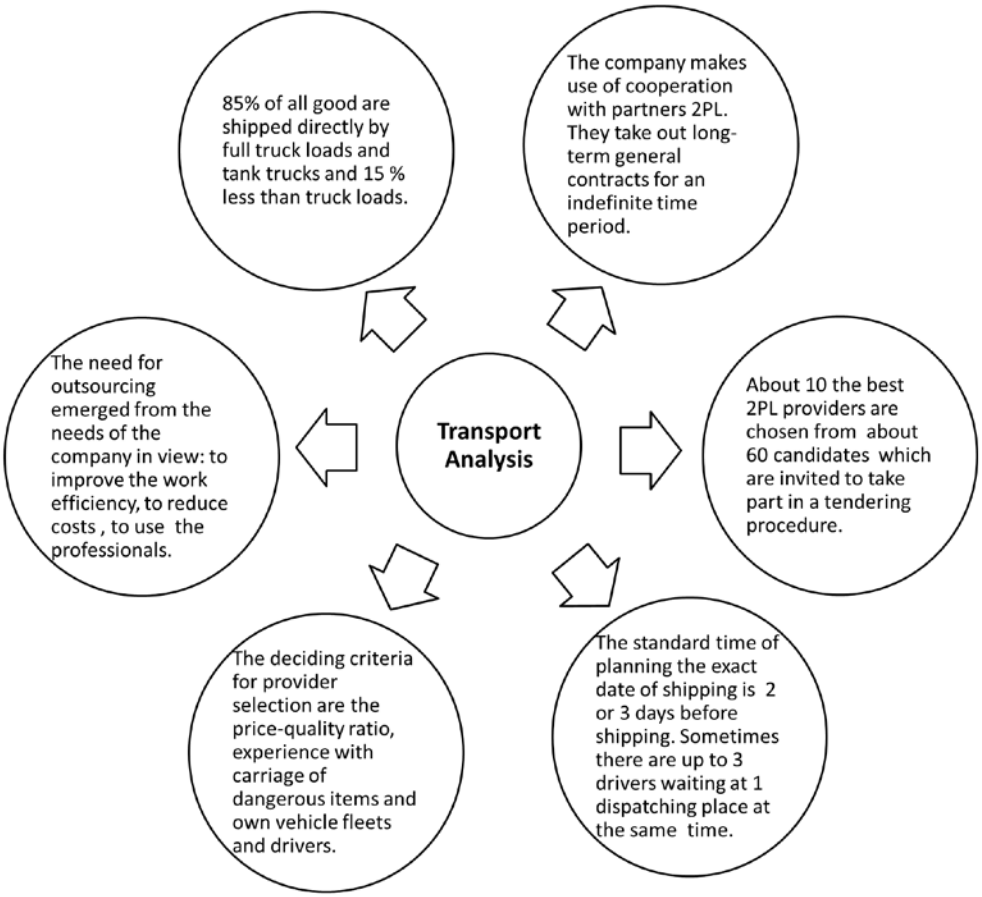

***Fig.1** Main results of transport analysis in the selected enterprise*

The company transports items by road, by rail, by sea, and by air. In the past they mostly used rail transport because they transported large quantities of items. For the reason of transformation of their product lines and changes in the customers' requirements in the 90's, the company started to focus on road transport as the volumes of consignments were no longer that large. However, the company did not have its own vehicle fleet. The need for outsourcing of transport thus emerged from the needs of the company which especially opted for it in view of the work efficiency, lower costs, and the professionalism of providers.

The company divides road transport into high-volume and unit transport. As for high-unit (direct) carriage, the items are loaded in the company and unloaded at the customer's place without any other reloading. 85% of all good are shipped this way. They use mainly full truck loads and tank trucks, but also vehicles with a smaller capacity, whose advantage is especially the swiftness of delivery (delivery takes 1 day). The high volume carriage category also includes less than truck loads (15% of items), where the carrier ships consignments sent to the same destination by more consignors on one vehicle. Unit transport, also called a collecting service, consists in collection of the items by the carrier directly from the company's warehouse and transport to the own collection site, from which the items are gradually distributed to the customer via other collection sites. However, more frequent handling of items increase the risk of their damage or loss. Therefore, the company uses this way of transport exceptionally only.

Shipping of items, choice of the carrier and the forwarder, customs proceedings, and consultancy in carriage of dangerous items are arranged, within the company, by the Department of Transport and Customs Clearance with 6 employees. The company makes use

of cooperation with outside partners on the level of 2PL. They are not considering cooperation on a higher level, particularly for the reason of safety of dangerous items carriage, but also for the reason of protection of their know-how. About 60 2PL providers are standardly invited to take part in a tendering procedure held about every two years, and the best candidates (about 10) are chosen from them in several rounds (at least three) to provide the company with transportation services. Nowadays, the transport market faces oversupply of providers, which makes it possible to specify more strict parameters for their selection. First of all, the deciding criterion is the price-quality ratio (swiftness, reliability, and completeness of services). The other important criteria include experience with carriage of dangerous items, and if the given provider has its own vehicle fleet and own drivers. This is a very important aspect for the company, mainly for the reason of better control over the course of a business case. The company takes out long-term general contracts for an indefinite time period with the selected providers (with respect to the specifics of carriage of dangerous items) with a two-month cancellation period, based on the CMR Convention.

A business case always starts, from the point of view of road transport, with a tendering procedure performed to choose the provider. The selected provider is sent a transport inquiry. In the case, it is accepted, the provider draws up a shipping quotation on the basis of which the company sales representative places a shipping order. Shipping scheduling depends on the confirmed shipping orders. One week in advance, the company knows what will be shipped, but they often do not know the exact date of carriage. This is mainly given by the production anomalies, e.g. they do not manage to manufacture or pack the items, check the quality, or issue items certification. Also, even after confirmation of a shipping order, there are changes in the volume of the consignment made from the side of the recipient. That is why the standard time of planning the exact date of shipping is only two or three days before shipping. Scheduling is performed longer in advance only if it is the case of a new destination.

The driver's arrival at the company is planned according to the business hours of the warehouse from 6am to 1.30pm, when it is possible to load the items. There is a risk that the business hours of the warehouse could limit observance of the delivery time. Therefore, it would be suitable to prolong the business hours of the warehouse flexibly in such cases. The driver is informed of the time period within which he/she is to arrive at the company. It is also possible to agree with the driver on a change in the arrival time if he/she contacts the company managing clerk responsible for shipping. In spite of that, sometimes there are up to three drivers waiting at one dispatching place at the same time. This results in time delays disrupting the entire shipping process. Such a situation could be solved through better scheduling of arrivals of individual driver at the company area. The necessary data is gathered in the internal ISDL system and generated directly from it. The Transport and Customs Clearance Department staff uses the data to make an overview of the fact how the contractors observe the agreed shipping conditions from the point of view of the time of delivery to the recipient, and also to evaluate the reasons for any potential failure to meet the items delivery time. This is usually caused by occurrence of unpredictable situations during carriage (traffic jams, accidents, vehicle breakdowns, bad weather, etc.). About 10 consignments out of the total of 600 consignments per month are delayed. Long-term breaching of the delivery time could even result in termination of cooperation with the given contractor. However, there has not been a case like this yet. Exceptionally, the items are delivered to the recipient earlier than agreed. This could cause complications as the items are not always taken over by the recipient, and the driver has to wait until the agreed delivery time.

Another exceptional situation is that the required items are not ready for dispatch. Prolongation of the drivers' waiting time is irregular; it can be about half an hour only, but in isolated cases the delay can be two or three hours long. Again, this slows down the entire

shipping process. The company could achieve some improvements through better coordination of activities in the logistics chain, which would ensure smoothness of the shipping process and shortening of the drivers' waiting time. It could also be suitable to consider outsourcing on the level of 3PL. Another certain improvement could be brought by an increase in the safety stock. The material flows could also be smoother if the average items delivery time was monitored as a quality indicator of logistics services. From the point of view of the company, it is the time period from receipt of an order until it is dispatched, i.e. the necessary time for settlement of an order, preparation in the dispatching warehouse, and, as the case may be, the production time unless the items are in stock. This way, the company would have an overview of the fact how long the process from order confirmation to dispatching actually takes, and it could plan arrivals of individual drivers at the company premises better.

6 CONCLUSIONS

Transport and shipment play an important role in the process of achieving perfect delivery and in the process of increasing the customer value. They account for the largest part of logistics costs. In addition to that, when shipping dangerous items, it is necessary to observe a number of legal regulations and rules. That is why transport belongs to the most frequently outsourced activities in chemical industry enterprises. These enterprises use mainly road freight transport, or combined road and rail transport. To arrange such transport, they can cooperate with providers on any level, but they usually use 2PL. If an enterprise transfers shipment of dangerous items to an external provider, it can achieve cost savings, but it has to take account of the fact it is still obliged to meet the obligations and responsibilities connected with transport of these items.

The company mainly decided to outsource transport for the reason of increasing the work efficiency, cost reduction, and the providers' professionalism. It takes advantage of cooperation with external providers on the level of 2PL, with whom it has entered into long-term general contracts for an indefinite period of time. For the time being, it is not considering cooperation on a higher level for the reason of ensuring transport safety and protection of its know-how. The deciding criterion for choosing the right provider is the price-quality ratio, experience with dangerous items carriage, and own vehicle fleets and drivers. The following measures have been proposed to improve smoothness of the shipping process and its acceleration: to make planning of arrivals of individual drivers at the company premises more precise using data in ISDL and thus to shorten the drivers' waiting time, to monitor the indicator of the average items delivery time and use it for more precise transport planning, and particularly to make coordination of activities within the logistics chain more effective, or to consider outsourcing on the level of 3PL.

References

[1] M. Christopher, Logistics and Supply Chain Management: Creating value-adding networks, third ed., Financial Times/Prentice Hall, Harlow, 2005.

[2] I. Gros, S. Grosova, Supply Chain Management, first ed., Vysoká škola logistiky o.p.s., Přerov, Czech Republic, 2012 (in Czech).

[3] D. Folinas, Outsourcing Management for Supply Chain Operations and Logistics Services,Business Science Reference, Hershey, PA, 2013.

[4] K. Lysons, Purchasing and Supply Chain Management, seventh ed., Financial Times/Prentice Hall, Harlow, 2006

[5] J. P. Dittmann, Supply Chain Transformation: Bulding and Executing an Integrated Supply Chain Strategy, McGrawHill, New York, 2013

[6] P. Pernica, Logistics (Supply Chain Management) for 21st century, Radix, Prague, 2005. (in Czech)

[7] H. Lostakova, M. Bednarikova, L. Branska, J. Dedkova, V. Janouch, M. Jelinkova, J. Nozicka, Z. Pecinova, J. Simova, J. Vavra, and V. Vlckova, Differentiated Customer Relationship Management, Grada Publishing, Prague, 2009 (in Czech).

[8] M. Kannegiesser, Value Chain Management in the Chemical Industry, Physica-Verlag, Berlin, 2008.

[9] R. Novak, et al., Přepravní, zasilatelské a logistické služby. Wolters Kluwer, Czech Republic, 2011.

[10] J. Siroky, et al. Technologie dopravy. Institut Jana Pernera, Pardubice, 2011. (in Czech)

[11] V. Cempirek, R. Kampf. Logistika. Institut Jana Pernera, Pardubice, 2005.

[12] I. Bartlova, I. Nebezpečné látky I. Edice SPBI SPECTRUM, Frýdek-Místek, 2012 (in Czech).

[13] P. Petruncik, P.: Silniční přeprava nebezpečných věcí v praxi ADR 2011. Praha 2011. 187 s.

[14] A. Rushton, et al., The Handbook of Logistics & ditribution management. 4th ed. Kogan Page, London, 2010.

[15] J. Mangan J. et al, Global Logistics&Supply Chain Management, second ed., Wiley, Great Britain, 2013

[16] J. Langley, Third-Party Logistics Study, Information on http://www.3plstudy.com/key-findings/, 2012.

[17] L.Tetrevova, V. Vlckova, Strategic Alliances in the Context of Strategic Partnerships from the Point of View of the Czech Republic, 4th WSEAS World Multiconference on Applied Economics, Business and Development (AEBD '12) Recent Researches in Business and Economics, 2012, pp. 35-40.

[18] M. Janda, Audit DTQS: Spolehlivá a bezpečná přeprava. Nebezpečný náklad. Prague, 2012. (in Czech)

[19] M. Valek, SQAS. Information on http://www.prodopravce.cz/sluzby-31-6.php/.