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**ANALYSIS OF STATUS OF LOGISTICS
IN CHEMICAL INDUSTRY ENTERPRISES
IN THE CZECH REPUBLIC**

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This paper deals with an analysis of the status of logistics management in the chemical industry enterprises in the Czech Republic. The analysis starts from our own survey. The most important factors of the logistics development with regard to the needs of assessment of the implemented survey, particularly to understanding of the level of logistics in individual enterprises are given. The analysis is focused on the organizational arrangement of logistics activities, the level of perception of the logistics system by managers, transformation changes within companies affecting logistics, utilization of logistics technologies, information systems and quantitative methods for management of logistics processes. Gradual qualitative shift in the logistics management in the chemical industry businesses is obvious. However reluctance and distrust of data and information sharing within the supply chain are still persisting.

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Introduction

Present-day customers and consumers place bigger and bigger demands on the quality and level of services and products provided by their suppliers, which means also chemical industry enterprises. At the same time, the markets have a tendency to “age” quickly. Well-informed and demanding customers tend to be far less influenced by the traditional marketing communication, but what is deciding for them is availability, quickness of reaction and the provided services. On the other hand, the typical features of the present markets are changeability, high rate of change dynamics, difficult predictability, globalization, international migration, progress in the areas of information and communication technologies, transport development, bigger emphasis on the environment and creation of networks. All these factors significantly affect logistics and supply chain management. Progressive methods are being developed and applied in logistics using modern ICT, economic entities are being distinctly interconnected in networks, logistics costs are being thoroughly monitored and optimized through integration of purchase, production and distribution; coordination and cooperation not only with the customers but also with the suppliers are being deepened. All the above activities are aiming to achieve synergic effects. The mentioned paper deals with an analysis of the status of logistics management in the chemical industry enterprises in the Czech Republic. The analysed data was obtained mainly through our own survey carried out in 2010-11.

Theory

To carry out an analysis of the status of logistics management in the chemical industry enterprises, it is necessary not only to specify modern trends in logistics and in supply chain management, but also to understand its development up to now. This question is being dealt with by a number of authors, e.g., Alan Rushton and co-authors characterize distinct stages in the development distribution and logistics since 1950 by individual decades [1]. Some other authors, e.g., Sixta, Pernica, divide the development of logistics in the economic practice into 4 phases [2,3]. This classification is based on the important incentives for the logistics development with respect to the dramatic changes in the social environment after the Second World War. Pernica then characterizes individual phases in detail in the context of the basic definitions of logistics, a supply chain and supply chain management. There, he only states the most important factors of the logistics development with regard to the needs of assessment of the implemented survey, particularly to understanding of the level of logistics in individual enterprises.

In the first development phase, logistics was limited to distribution only. Total costs started to be used to judge effectiveness of the processes and their

reorganization. This period culminates in the 1960's.

In the second phase, where the enterprises were forced to look for cost reserves, they turned their attention to the stock. Thus, logistics gradually extended to purchasing and production. This means that it already covers all the basic functions of the enterprise, but it is applied separately. The demand for individualization in the 80's radically changed the market, and the control over the market was taken by the customers. Arrival of personal computers and development of information systems made it possible to analyse the material flow, and logistics focussed on value-creating processes. In the late 1980's and early 1990's, logistics covered the combining of materials management (the inbound side) with physical distribution (the outbound side). This led to additional opportunities to improve customer service and reduce the associated costs. Informational aspects were as important as physical aspects in securing an effective logistics strategy [1].

The third phase saw the beginning of creation of coherent logistics chains and systems interconnected from the suppliers to the final customers. This results in horizontal integration. Their formation is conditioned by development and application of technology for transfer of logistics information — EDI. The main goal is to strengthen competitiveness of enterprises through enhanced flexibility, by means of the process coordination and synchronization. However, logistics is still in the position of a mere, even though qualified, executor of marketing dispositions, i.e. in the position of a performance implementer or provider. The pressure on the increasing level of the customer services leads to connection of the corporate functions from the operational level to the strategic level (vertical integration). This is known as supply chain management. A supply chain encompasses all activities in fulfilling customer demands and requests, and includes procurement, production, distribution, but also waste disposal, including the associated transport, warehousing and information technologies. The established designation of such complete chains is “The Total Supply-Chain” [4].

The fourth, now running phase is about optimization of integrated logistics systems. It is a complex problem of a system character. To be successful in this phase, it is necessary to create a number of conditions, among others in the area of computer integration, including simulation software to support decision-making process on both structural and procedural levels, electronic data interchange (EDI), electronic mail, electronic messaging, electronic business etc. It is essential to make partnerships or alliances with other enterprises, their customers, tangible goods suppliers, and with the providers of logistics services, based on mutual confidence, transparency of information and even open-book accounting of all the involved partners [2,5]. Today's global links among economic entities characterized by significant interconnection are described as the network economy. These networks are characterized by their vastness and complexity, growing overload, complementarity, externality, cost of change, different behaviour of the

network users, and by mutual interaction among networks [6]. Logistics must become a part of the global strategy. A company's supply chain in an e-Biz environment can be very complicated, because many companies have hundreds and thousands of suppliers and customers. Simplified supply chain includes internal supply chain functions, an upstream supplier network, and a downstream distribution network [7]. Another precondition is that logistics services must belong to the key tools to achieve better competitiveness of the enterprise with optimal costs. All the above things place huge demands on logistics specialists. Therefore, they must manage, in the area of the professional know-how, knowledge from the areas of logistics strategy, logistics systems, including transport systems, planning and production management, logistics approach to the global business, procurement and distribution in the European and world-wide market conditions. In the area of methodological know-how, specialists must be able to design logistics systems, select and assess prognostic models, logistics information systems, human resources, financing and controlling, operational research, modelling and simulation [2]. Specialists must be able to evaluate their suppliers, e.g., through a dynamic system of suppliers' evaluation in which the values of weights and the classification scale automatically adapt to the number of the actually evaluated criteria [8].

The concept of logistics and supply chain management is now moving towards the need for logistics and supply chain partnership. The overall trend, reinforced by information technology, is towards greater integration throughout the whole supply chain [1].

Important logistics trends then include cooperation, flexibility, information sharing, real-time Internet communication, application of new information and logistics methods and technologies, utilization of logistics services providers, synchronization, overall optimization and integration of the whole supplier chain, networking and establishment of virtual organizations. The SCM concept is oriented on effective provision of services to individual customers and based on cooperation and openness during information transfer between individual links of the chain. At the same time, it uses the methods like JIT, KANBAN, QR, ECR, and CPFR. Only if the companies are willing to "open" from the organizational and technical points of view and give up "unlimited sovereignty" as for information and processes, they will become interesting partners in the world-wide networks on B2B markets. The CPFR system aims to strengthen mutual relations during common management of planning processes and information sharing [9].

The logistics implementation process itself is a never-ending process of logistics reengineering. However, as early as in the phase of designing the logistics concept, it is necessary to observe certain principles that create a precondition for its successful implementation. Pernica has included them in the so-called "Logistics Ten Commandments" [4].

Experimental

The survey was carried out in the form of written questioning within the diploma thesis [10]. The questionnaire was drawn up in MS Office Excel, which was chosen due to easier transformation of the data for processing. The data was evaluated using Microsoft Excel 2007 and the statistical IBM application SPSS Statistics 19. Written questioning has its limits, and so it was not possible to cover all the extensive range of problems of the current logistics in companies. The scope of questions was chosen in the way to be particularly able to identify, from the survey outcomes analysis, in which logistics developmental phase the companies are and the most important logistics trends in the chemical industry companies. In line with the set survey targets, the questionnaire was divided into seven parts and it consisted of 23 questions (including the identification data). There were both open and Yes/No questions. To verify intelligibility and unambiguousness of the questions, the questionnaire was piloted in the selected chemical industry enterprise. In spite of this, the evaluation showed that there were companies for which some questions were difficult to answer in writing, or whose policy did not allow answering some questions specifically. These problems occurred particularly in the part related to transformation changes. The questionnaire was emailed to 50 production companies. All of them are members of the Association of Chemical Industry (SCHP). A filled-in questionnaire was returned, despite repeated sending and intercession of the SCHP, by only 11 companies, i.e., 22 %. The total 2009 sales of these 11 companies amount to 5.65 % of the sales of all SCHP companies, and the number of their employees represents 4.99 % of all the workers employed by SCHP companies.

Results and Discussion

Low return of the questionnaires in combination with the used method of written questioning, big diversity of the respondents (from small companies to large corporations with multinational management), did not make it possible to generalize the outcomes concerning the status of logistics in the entire area of the chemical industry in the Czech Republic. However, by completing these outcomes with the author's experience from the previous similar surveys carried out in 1999 and 2002 [11] and with the outcomes of the in-depth interviews with the logistics managers in 4 businesses, which were also involved in at least one of the previous surveys, it is certainly possible to come to the relevant conclusions concerning the trends in the development of logistics in this industry.

The questions in the first part focussed on the organizational arrangement of logistics activities. The outcomes showed that $\frac{3}{4}$ of the companies have a separate logistics department. In view of disunity in the terminology, the logistics

departments have different names; they also have different superior units, and different numbers of employees. This data is summarized in Table I. In 3 businesses, the logistics department belongs to the second level management. In another 5 businesses, logistics is incorporated into the third level management. Nowadays, it is possible to notice a drift towards flattening of the branched corporate structures to the lowest possible number of management levels in the way to make the company capable of reacting to the changes in its surroundings more quickly. This trend is also visible when the functional management is switched over to the process management.

Table I Organizational arrangement of a company and numbers of employees

Company	Name of organizational department	Superior organizational units	Numbers of employees total	Numbers of employees in logistics	% of employees in logistics
1	logistics of sale	sales section	450	29	6.4
2	logistics	sales department	63	4	6.3
3	production and logistics section	director	19	3	15.8
5	section of purchase and supply chain	managing director	750	51	6.8
6	section of dispatching	production division	61	12	19.7
7	logistic division	operation section	1720	40	2.3
8	fulfil team CZ/SK	multinational management	250	9	3.6
9	purchasing department	sales department	100	3	3
10		No logistics department exists.			
11		No logistics department exists.			

Logistics departments have between 3 and 51 employees. This number depends partly on the total number of the employees of the company and on its size, but also on a lot of other factors, e.g., which level of management the logistics department belongs to, on its internal structure, on the scope of activities they perform. Smaller enterprises preferably require that the workers are universal and manage more activities than their defined specialization, e.g., just in logistics. Although a company does not have a separate logistics department, which mainly refers to small companies, it still does not mean that the company has no logistics management. What is decisive is the fact how logistics activities are managed and carried out in the company. In total, the questions related to 28 activities that were

associated with the logistics department. In the case of the companies that did not have a logistics department, these activities were associated with other company departments performing them; they were mostly departments of production, purchase, sales division and dispatching.

In more than 1/2 of the companies, logistics departments deal with processing and settlement of orders, purchase planning, storage of finished products, shipping, inter-operational internal transport, and customer services management. At least in a quarter of the companies, they are involved in distribution planning and management, purchase of material, unfinished and finished products storage management, storage of production stocks and spare parts, packaging, transport of raw materials and finished products, and monitoring of logistics costs and receivables. Other activities are not usually carried out within the logistics department. Only in one company, the logistics department deals with production planning and storage of unfinished products. No logistics departments in any of the questioned companies are engaged in forecasting the demand, or the sales estimation and backflow management. It is mostly ensured by the sales division, in one company by the customer service department, and in one company by the production and sales coordination department. Backflows are managed in six companies, but by the sales division or department.

In general, there is a clear trend towards extending the scope of activities carried out by logistics departments, which leads to integration of logistics activities. For example, the activities of accepting and processing orders have, compared to the 1999 survey, moved to the logistics department mostly from the competence of the sales division, while the activities of warehousing and packaging have been transferred from the competence of the production division [12]. Some activities are being transferred to the competence of external companies, e.g., shipping, operation of the logistics information system. We can also see new organizational structures and new working positions like a product manager, who can be in charge of a product or a group of products, or even the whole chain, i.e. from the market research, development, purchase, production, to distribution, including backflows.

The second part of the questionnaire monitored the level of perception of the logistics system. The outcomes of this analysis from three surveys carried out within the period of 12 years have already been processed in more detail [13]. The orientation of the enterprise on the customers was considered, for the whole period, as the most important property of the logistics system and the most observed principle of successful implementation of logistics in the chemical industry businesses. The second most observed principle is making logistics systems more flexible through coordination of material flows with the suppliers and the customers. The outcomes of the research show that, monitoring of the logistics costs and businesses training their staff in the area of logistics are more and more important for the company management. It influences also better understanding of

the role of logistics in these companies. The biggest number of negative answers in all the three surveys at all was on the question “Are you a part of a supply chain managed in the integrated way as a whole?” Companies are continuously decreasing the average stock of finished products and raw materials, and they are also trying to reduce their costs this way. On the other hand, to increase the customers’ satisfaction, most companies are trying to extend the range of their products, increase the level of their customer services by, for example, introducing EDI, ISO 9001, a customer service, staff training etc.

The third group of questions aimed, above all, to find out whether there have been any transformation changes affecting logistics in the last ten years. The outcomes are shown in Table II.

Table II Transformational changes in the chemical industry enterprises

Have been any significant transformation changes affecting logistics in your enterprise in the last ten years ?			
Transformational changes/numbers of answers	YES	NO	Without answer
Change of the owner	8	3	-
Change of the legal form	1	10	-
Change of the name	-	10	1
Merger of enterprise	2	9	-
Substantial organizational change	5	6	-
Optimization of business processes	8	2	1
Decreasing the average stock of:			
finished products	6	5	-
semi-finished products	6	5	-
raw materials	8	3	-
Extension of the products range	8	3	-
Reduction of the products range	5	5	1
Significant change in the products range	4	7	-
Changes in the suppliers’ delivery terms	1	10	-
Change in delivery time of products to customers	4	7	-
Change of information system	5	6	-
Using of logistics service providers	3	8	-
Improvement in the level of the provided customer service	7	4	-

The most frequent change in the position and the organizational structure of a company was a change of the owner. Overall majority of the companies stated that it was a repeated change. The legal form changed in one company only. 6 businesses are joint-stock companies, 4 businesses are limited liability companies, and 1 business acts as a private individual. Only three businesses experienced a change of the name and a merger. A substantial organizational change was made in 5 businesses, and it related to unification of activities with the majority shareholder, privatization, foreign acquisitions for expansion to other territories,

and the corresponding changes in the organizational structure, setting some activities aside to a separate joint-stock company, establishment of 5 branches under the existing identification number, rearrangement of the European countries, cancellation or connection of a separate position of the production manager with another position; a change of the sales manager, installation and removal of the CEO. Most companies are continuously decreasing the average stock of finished products, semi-finished products, and raw materials. We can see both continuous extension of the range of products and one-time (3 businesses) or continuous (2) reduction. Fourth companies stated a significant change in the range of products, and these changes mainly concerned introduction of new products and product groups. Changes in the suppliers' delivery terms related both to shortening of delivery time from ordering and prolongation of delivery time. A more frequent change was seen in delivery time of products to customers both towards shortening of delivery time and towards prolongation of delivery time in relation to the suppliers' delivery time. The information system was changed in 5 businesses. It is also possible to see that external logistics service providers are starting to be used for external production planning, warehousing, distribution, shipping, where there is establishment of cooperation with new or cancellation of cooperation with unsuitable forwarders. Most companies see improvement in the level of the provided customer service. It is particularly utilization of EDI, maximum satisfaction of the customers' orders, improvement of the customer service, hiring specialists for individual product groups, training for customers, corporate seminars, and presentation of technical innovations for customers, ISO 9001:2000, stock management of delivered goods in the customer's place, provision of a free trial of goods, making data more transparent and accurate, and an e-shop. Companies often use various distribution methods, which indicate a trend to differentiation in the logistics management approaches. The whole range of customers is represented. They are mostly other processors of the production, but also the final customers. The smallest represented groups of customers are the company shops and sales representatives, and then there are retail chains and intermediaries.

The fourth, fifth and sixth groups of questions concerned very closely linked topics in the area of utilization of logistics technologies, information systems and quantitative methods for management of logistics processes. For application of logistics technologies, it is necessary to share information. Table III shows how individual respondents answered these questions.

Internal information sharing can be found in every company. However, less than a half of the companies share mutual information within the entire supply chain. Most companies do not provide their suppliers with information, and 3 companies do not share it with their customers. As the main reasons for non-sharing information, the companies stated their worries about its misuse and unwillingness to share it, and then, e.g., the variety of the distribution network. On

Table III Information sharing within companies

Information sharing	Certainly no	Rather no	Rather yes	Certainly yes
in supply chain	3	4	3	1
Do you provide information to:				
a) your particular enterprises departments/internal information sharing?	-	-	1	10
b) your customers?	1	2	6	2
c) your suppliers?	1	5	3	2
Who provides you information?				
a) your enterprises departments	-	1	1	9
b) your customers	-	1	7	3
c) your suppliers	1	2	6	2

the other hand, the smallest identified barrier was absence of a suitable information system. The companies mostly use SAP as their ERP. For logistics activity planning and management, the companies use a number of other special commercial software applications like, e.g., ESO 9, Wincont, Oracle E1 - POHODA, Helios, but also their own programs using commonly available software. The most widely used application is MS Excel. The best-known logistics technologies include JIT, which is used by 3 companies. 2 companies use CRP, CMI a CPFR. One of the companies using CPFR has multinational management and uses the world-wide information systems. On the other hand, nobody uses the KANBAN, CTM, SCR and Hub and Spoke.

The last group of questions related to utilization of quantitative methods and optimizing or simulating models for logistics processes management. In most cases, they are used for management of stock and warehouses (in 6 companies), 4 companies use them for shipping optimization, production planning, and forecasting the demand. Broader utilization of these methods is prevented, according to the respondents, by the lack of necessary information and also by unsuitable conditions for their introduction. Only one respondent stated that they do not have a suitable information system.

Conclusion

The survey carried out implies that the chemical industry enterprises focus on their customers, and they are trying, also in view of their specifics, to adapt logistics to

it. It is, in most of the analysed enterprises, in the third developmental phase, i.e. they are systems with different levels of interconnection of suppliers as far as the final customers. The respondents, apart from the exceptions, are not involved in an integrated logistics system that is optimized as a whole, which is typical for the fourth developmental phase. In the last about ten years, we can see a gradual qualitative shift in the logistics management in the chemical industry businesses. The so-called Logistics Ten Commandments are observed more than before. There is a clear trend to integration of logistics activities. In some companies, they are already managed by a separate logistics department on the second-level management, or external logistics services providers are used. A number of preconditions like computer integration, electronic data interchange, raising qualification of the logistics staff, closer cooperation with the customers, making data more transparent and accurate, and an e-shop are being gradually created for successful management of the fourth developmental phase. However, the companies still have not introduced a fully integrated system that they would be able to optimize as a whole using modern logistics systems, e.g., QR, ECR, CRP, CPFR. The biggest barrier to overcome is still the persisting reluctance and distrust of data and information sharing within the supply chain they are a part of. It is a necessary condition for implementation of cooperative strategies making the most of the synergy effect.

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