

COMPARISON OF LOGISTICS INDICATORS AS A WAY OF IMPROVING EFFICIENCY OF SUPPLY CHAINS

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Abstract Specifying the efficiency of both individual enterprise and the enterprises belonging to the supply chain is not a simple issue. Reason for this situation can be difficulty to choose the right set of indicators, defining indicators for all enterprises in a variety of ways, establish rules for the exchange of information and the use them by any of the enterprises or inadequate supporting the process by the systems. In this article was taken attempt to develop a process of measurement of indicators and the exchange of information, and prove impact of indicators at improve the efficiency logistics supply chains. In first step show areas of logistics, which to be assessed and been proposed a list of indicators to be measured in every area. In addition, open-ended questions were developed to help us assess the analyzed surface. Also discussed the process of exchange of information between companies, necessary is support this process by a computer system. In article also identifies the requirements which to be met by system due to the need to regularly generate and transmit values of individual indicators.

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1. INTRODUCTION

In recent years overlap essential transformation of the economic conditions in which enterprises function. These changes cause that the enterprise wanting to operate in the market and, more importantly, to develop and to bring the expected benefits, is forced to make changes to current operations. Therefore on a background awakening from the crisis of the economy can be seen the rapid development of new technologies, innovation growth companies, enhance their activity and increase in market competition, conditioned by an increase in expectations of consumers. Prolonged economic crisis has forced business entities to change the rules for their functioning and approach to implementing of activities, including logistics processes. In companies activity may be observed rapid changes priorities as manifested, among others, by increasing the emphasis on optimization of logistic processes. Enterprises have noticed huge importance of effective organization of these processes for achieving company's strategic objectives, particularly in for achieving the right balance between the margin for company, customer satisfaction and the level of costs incurred. Importance of efficient organization of logistics processes in enterprises confirms the analysis of logistics costs in different models of distribution system carried out under a series performed by Institute of Logistics and Warehousing research projects (CORELOG – COordinatedREgionalLOGistics, Individual research project No. 4 T12C 023 28PT. "Multimodal freight transport in Poland, in relation East - West and East - West", DIFFERENT – User Reaction and Efficient Differentiation of Charges and Tolls, Freightwise – Management Framework for Intelligent Intermodal Transport, KASSETS – Knowledge-enabled Access of Central Europe SMEs to Efficient Transnational Transport Solutions, DiSCwise – Digital Supply Chains for European SMEs based on the Freightwise Framework, Individual research project No. N N509 398536 "Intermodal logistics system in Poland – the concept of model solutions and implementation considerations."). Companies increasingly being are implementing new management concepts of logistics processes, based on reliable information, characterizing the current state of logistics, order to achieve defined precisely goals. Enterprises have attempted to generate indicators of logistics, which would allow for accurate assessment of the current state of logistics. However, it turns out that the analysis in this area is not easy. Simultaneously enterprises have noticed the huge importance of working with partners in the supply chain. Cooperation and exchange of information between companies have become a source of improving the efficiency of supply chains. In this article will be presented conception of comparator indicators of logistics and its role in improving the efficiency of the supply chain.

2. LOGISTICS AREAS SUBJECT TO MONITORING

Selecting appropriate indicators should be measured in order to allow adequate comparative analysis of enterprises processes. Consequently, the focus on improving the efficiency of the supply chain is quite a difficult task. This is due to cardinality indicators available in the literature and the multiplicity and diversity of their use in business practice. An additional difficulty during building an appropriate set of metrics is diverse specificity of enterprises, who are business partners in the supply chain.

Indicatory analysis should begin with the selection of suitable metrics, and identify the areas of logistics, which should be measured. The most important group of measures of logistic should cover areas such as (Kisperska-Moroń, 2001, p. 35):

- purchases,
- warehousing,
- production,
- transport,
- distribution.

Comprehensive analysis of the selection of the indicators of the manufacturing process is presented in an article by A. Koliński, in which focused on the aspects of environmental production efficiency (Koliński, 2013, pp. 93-102). In this paper, a proposal is made the system of indicators in the rest functional areas of logistics, with particular emphasis on (Śliwaczyński, 2007, pp. 124-147):

- inventory,
- warehousing,
- transport,
- and working with suppliers and customers.

As defined J.Twaróg term indicator can then be used when we are dealing with numbers appointees that relate to some appointed base and are used to assess the quantitative effects (Twaróg, 2003, p. 14).

To take account of the specificities of enterprises included in the supply chain, the indicators should be divided by the type of enterprise, using the following classification (Cudziło & Kolińska, 2012, pp. 141-162):

- distribution enterprises,
- production enterprises,
- logistics enterprises.

In addition should be remembered that indicators which are subject to measurement, and then are compared, should have the following characteristics (Kisperska-Moroń, 2001, p. 36):

- should allow the connection of operational activities to strategic objectives by transposing the purposes to routine activities,
- financial and non-financial information should be integrated the measures system in such a way that it is relevant and useful for managers,
- measures should allow the assessment of the client's needs.

Table 1 List of indicators in specific areas, taking into account the type of enterprise in which it should calculate the indicator; Source: own study based on (Dąbrowska-Mitek, 2008b, s. 13-19), (Śliwczyński, 2007, s. 139, 145), (Cudziło, 2010)

Area	Indicators	Type of enterprise		
		Production	Distribution	Logistics
Inventory	Coverage ratio	X	X	
	Contribution of non-rotating stocks in total inventory (in volume and value terms)	X	X	
	Rate of exceeded the scheduled delivery time (leadtime)	X	X	
	Rate of sale forecast accuracy	X	X	
Transport	The average rate of vehicle using	X	X	X
	Rate of transport fleet technical readiness	X	X	X
	Rate of the course using	X	X	X
	Rate of transport punctuality	X	X	X
	Rate of cargo damage during transport	X	X	X
	Contribution of transport costs in total enterprise costs	X	X	X
Warehousing	Rate of warehouses exploitation (in volume and value terms)	X	X	
	Rate of surface inventory management (in volume and value terms)	X	X	
	Rate of cubature inventory management (in volume and value terms)	X	X	
	Rate of warehouse operations performance (in volume and value terms)	X	X	
	Rate of warehousing costs in relation to the turnover of enterprise	X	X	
	Rate of warehousing costs in relation to the inventories value	X	X	
	Productivity of staff for operations admissions	X	X	
	Productivity of staff for operations picking	X	X	
	Productivity of staff for operations issues	X	X	
	The cost of a single order picker	X	X	
Working with suppliers and	Rate of timely delivery by suppliers [%]	X	X	
	Rate of time delivery to customers [%]	X	X	X
	Rate of the order fulfillment [%]	X	X	X
	Rate of complaints to suppliers [%]	X	X	
	Rate of complaints from customers [%]	X	X	X

Table 1 provides a list of indicators in specific areas, taking into account the type of enterprise in which it should calculate the indicator. Statement includes a sample list of indicators, which in authors opinion should be measured and compared in order to benchmark companies in the supply chain. It also should be allow for possibility to increase efficiency through the implementation of appropriate measures to improve the enterprise process. In addition to measurable indicators of the assessing the supply chain efficiency process, may also include soft questions concerning the evaluation of processes. Among these questions are the following issues:

- in the inventory management area: Is the safety stock and forecasts are determined?; If the forecasts are determined, what level of accuracy?; Does in enterprise use a information system to support the activities in the inventory management area?; Which activities in the inventory management area are supported by the information system?
- in the warehouse management area: What kind of technology is used in warehouses? (storage of using facilities or without using); Does in enterprise use a information system to support the activities in the warehouse management area?
- in the transport management area: Does in enterprise use a information system to support the activities in the transport management area?; Which activities are supported by the information system?

Analysis of the logistics processes efficiency in the supply chain should be based not only on the operational indicators directly related to the processes, but also on financial indicators. Objectives and measures of analysis of logistic processes efficiency should result from supply chain strategy. Efficiency analysis should be considered as complete if it relates not only to those measures which are the results of the past, but also for allowing measures to monitor what affects the performance in future. The complete evaluation problem of the logistics processes efficiency is not currently elaborated in the literature. Taking into account ecological aspect, the problem of logistics efficiency assessment can be based on the assumptions of Balanced Scorecard developed by R. Kaplan and D. Norton. The authors proposed the analysis of efficiency from four perspectives: financial, customer, internal business process, and learning and growth. Many companies already have performance measurement systems that incorporate financial and nonfinancial measures. What is new about a call for a "balanced" set of measures? While virtually all organizations do indeed have financial and nonfinancial measures, many use their nonfinancial measures for local improvements, at their front-line and customer facing operations. Aggregate financial measures are used by senior managers as if these measures could summarize adequately the results of operations performed by their lower and mid-level employees. These organizations are using their financial and nonfinancial performance measures only for tactical feedback and control of production process in short-term (Kaplan & Norton, 1996). Referring assumptions Scorecard in terms of the supply chain should be noted that the developed system of indicators to assess the logistic processes efficiency must include the SCOR assumptions.

3. PROCESS OF SHARING INFORMATION ABOUT THE MEASURES BETWEEN ENTERPRISES

In order to implement the compare logistics indicators in the supply chain should be organized process that will implement a defined purpose. Therefore, the process of measurement indicators and the share of information about the ratios between companies should follow the steps below:

1. Defining indicators to be measured.
2. Determination of the indicators calculation formulas.
3. Developing a consistent way to measure the indicators.
4. Determining frequency of communication about the values of individual indicators.
5. Selection of enterprises which achieved the best results in the specified indicator.
6. Meetings, during which the best practices are presented by individual enterprises to improve supply chain efficiency.

The decision of the statement of comprehensive set of indicators is dependent on the following factors:

- type of enterprises occurring in the supply chain or the group of enterprises undergoing benchmarking
- type of business relationships between enterprises in the supply chain
- using of logistics strategies at individual companies, as well as the entire SC,
- the need for orientation of the satisfaction the final customer,
- orientation of the ecological aspect.

Among the indicators listed in Table 1 and others, which are used in companies, not all of them should be exchanged and comparing the supply chain. The main reasons for this is access to strategic information about the company through the value of the indicator, and others lack the significance of the index for other enterprises. For this reason, an important element is the appropriate choice of analysis process analysis indicators and comparison of enterprises group.

The development of one standard of information exchange and to the measurement of the indicators to be monitored is an important factor affecting the accuracy and reliability of the reported values of indicators. It is very important problem, since most of the indicators are determined from the volume which are characterized by different units of measurement. Determination of standard of information exchange may therefore be an essential element in developing an indicators system.

The collection of the indicators, their archiving and then the comparison should be supported by the platform. The platform should be available electronically, to allow unrestricted access to each enterprises at any time. The use of such a platform facilitates communication between enterprises. This also no need to delegate tasks to the employee in compiling the information provided by other companies, and prepare reports comparing individual indicators. All these tasks are performed by an online platform that allows you to compare rates with respect to the sector in which the firm functioning, not only in respect of all companies.

An example of a platform having the functionality described above is a platform LogiBar. This tool is used to collect, monitor logistics indicators, thus enabling easy, fast and reliable assessment of the logistics processes efficiency from other enterprises. (www.logibar.net)

4. SUPPLY CHAIN OF EFFICIENCY AND LOGISTICS INDICATORS

Analysing the aim of generating and monitoring of logistics indicators, it is necessary to consider the impact of such action on individual companies, as well as refer the implications between the measuring of logistics indicators, their collection and comparison in the group of companies and between the efficiency of supply chains, which they make up.

As a result of using an extensive system of logistics indicators, company has a package of key and constantly updated information, which are the base for process improvement. Values of logistics indicators and the trends of their changes, constitute an important factor in many decision-making processes such as supplier selection, the choice the methods of sales forecasting, the choice of the date of the order to the supplier, the selection of vehicles and routes in the transport planning process etc. Uncovering a sudden change of some rate and taking timely preventive action, can lead to avoid the negative effects and incurring unnecessary costs. Such examples can be multiplied. Current monitoring of stock levels and relate them to the level of sales is necessary for making decisions, related with the moment and the size of the order to the supplier, as well as for prevent the situation of shortages in stock and ensuring adequate availability of goods. By monitoring the actual delivery times it becomes possible to reliably suppliers evaluation and, in terms of strategic, establish cooperation only with partners who fulfill the conditions of contracts. On the other hand, solid and periodic measurement of logistics indicators can evaluate the state of development of processes in the company and the impact of made decisions on the achieved results. The aim of the logistics strategy of company should be to achieve a high degree of implementation of service delivery. The success of this strategy depends largely on the instruments used for their implementation, monitoring and evaluation (Twaróg, 2003, p. 25). The periodic generation of logistics indicators is an effective mechanism for monitoring and evaluation of actions.

Knowledge of the current level of logistics indicators and their interrelationship will also let to analyse the potential consequences of decisions. It is often the case that the introduction of a single, even small change, will lead to big changes in several other areas. An example is the decision to increase the level of safety stock. This decision will change the coverage ratio, the change ratio of freezing capital, stock maintenance costs etc.

However, it should be remembered that the value of the indicator, generated once, does not always answer the question whether it is good or bad level. Only analysis of changes the specific indicator over time, as well as its comparison with other indicators or normative values, gives a picture of the situation in the company. Evaluation of logistics ratios can enable, among others (Blaik, 1997, p 43):

- identification of "weak points", i.e. areas of activity that are characterized by low productivity and need to be improved,
- creating strategic plans for the company,
- observation of trends, making it possible to introduce mechanisms for early warning of potential threats and opportunities for the company,
- provide feedback on the effects of previously implemented improvements.

Going further, it should be consider the impact of comparison of logistics indicators in a group of companies on the efficiency of supply chains that they form. In this case, due to the need for cooperation between all participants in the supply chain, it is necessary to move from individual measurements of the logistical operations in a single supply chain in the direction of indicators of whole process. Supply chain connecting suppliers and customers should create a coherent and integrated whole. Logistics processes implemented jointly through the companies within the supply chain, need to be coherent, the chain was sustained and reached its objectives. Often the strength and effectiveness of the supply chain is conditioned by its weakest link, according to the principle that the system is as strong as strong is its weakest link. Moreover, in the analysis of the supply chain, should be keep in mind the Forrester effect called effect of enhanced demand changes (called also bullwhip effect, whiplash effect or whipsaw effect). The relatively small deviations of final demand from customers significantly increase as the transmission of information on demand up the supply chain. This leads to excessive investments in stocks, in order to meet an uncertain and diversified demand. As a result, the inventory in the initial cells of supply chain are in fact greater than that required by the variability of the demand in final cells in supply chain (Witkowski, 2003, p 72). When you move to the next level of the distribution channel, the inventory level increase, which is due to growing demand disturbances. Decisions regarding stock level are taken independently of each cell of the traditional supply chain. Similarly, the procurement policy depends on the internal procedures of companies. In this context, comparison indicators within the group of companies is particularly important. Thanks to it, it will be possible elimination of a number of negative phenomena, such as large variations in sizes of orders, inventory levels, periodic overloads and low fulfillment of vehicles, etc.

It should be emphasized that the key to improving the efficiency of supply chains is to compare indicators. The measurement itself can be a valuable basis for decision-making in the scale of a single company, but from the perspective of the supply chain, or a group of independent companies, the key is to compare indicators. At this point it should be stressed again the need to meet the basic conditions, that

makes comparison effective. This includes the standardization of indicators, i.e. the determination of clear definitions and how to measure in a group of companies.

The process of continuous measurement of indicators, characterizing the quality of the logistics process and comparing them with cooperators or competitors (in the case of independent companies) recognized as the best, is very important in logistics. It allows for continuous correction of the activities carried out in the process. Also thanks to it is possible to optimize decisions and adopted criteria for their making, so as to ultimately lead to the achievement of both internal business purposes, as well as satisfy the expected degree of customer requirements. The knowledge gained from benchmarking research based on comparison of logistics indicators, may pose the base of construction of operational plans, determining how to achieve the best practical action patterns. The natural result of a comparison of logistics indicators will therefore improve existing activities and the implementation of new standards of logistic processes, which in turn will lead to an increase in the level of efficiency of the logistics system.

5. REQUIREMENTS FOR INFORMATION SYSTEMS

Measuring, collating and comparing indicators of logistics requires the assistance of IT tools. Manual preparation of data, "creative" calculation and compilation of indicators of logistics with the use of paper are inefficient and unreliable, and in the case of large enterprises, even impossible.

As mentioned, the basis for an effective comparison of the indicators is the adequacy of the data used in the measurement process, the timeliness and periodicity of analysis. These conditions can be met by the IT system. However, one should realize of the fact that the functionality of the IT system supporting analysis of indicators of logistics should focus not so much on the complexity of components analysis and reporting modules, which affects the efficiency of registration modules. Should be remembered that the indicators and reports will be so proved valid, as far as sound and adequate will be information. But now many companies are not aware of it, claiming that the mere possession of an advanced IT system module to generate analytical reports constitute an indicator of knowledge.

Information systems should collect data containing both actual and the planned values (such as the planned delivery dates, planned sales value at the strategic level, etc.). This functionality is important for the logistics processes efficiency. This justifies the embodiment of unloading goods at the designated lead times. The information system should generate information on the planned date and time of unloading. After the unloading, system should generate the actual date and time of unloading. The confrontation of these two parameters to determine the rate of delay in delivery, which further refers to the values of deliveries punctuality. Moreover, to generate an alert for registered delay can be the basis of the causes

analysis and take action to prevent the emergence of such discrepancies in the future. Therefore, it should be noted that the comparison of planned information and the actual data is not only the basis for the analysis, but also valuable information to take preventive or remedial action.

Another feature that should have information systems to effective support of comparison of logistics indicators is their proper scaled and configuration that will enable efficient power supply modules reporting and analytical data. Mechanisms used for loading, conversion, processing, and the generation of indicators should not adversely affect the performance of other IT system modules or operating systems.

An important added value for the information systems to support monitoring of logistics is the ability to share specific data packet and on-line indicators for contractors or suppliers and customers. This functionality can be implemented through information portals integrated with IT systems and provided to clients. This allows customers to verify the effectiveness of such services and to confront it with the contractual parameters. For these functions, it is essential to provide a number of security requirements, certification and proper separation of data between the receivers of information.

6. CONCLUSION

Analysis of the efficiency of logistics processes is a difficult task at the level of essential. The cardinality of indicators that are used in enterprises causes a danger that they will be mutually exclusive. Another problem is the need to integrate the flow of information throughout the supply chain. Analysis of Benchmarking, however, allows for the integration of information within used of the indicators, the preferred values and levels of designated measures, as well as strategic decisions and operational affecting the efficiency of the logistics process. Carrying out the analysis and developing of a system of indicators used to comprehensive evaluate the effectiveness of logistics processes should take into account the specificities of enterprises as well as branches and even aspects of ecological, geographical and cultural. Comparison of indicators of enterprises in the same industry, but characterized by a different work culture, it can cause the opposite effect to that intended.

An important aspect of the comparison of indicators efficiency of logistics processes is the need for IT support for the generation, storage and reporting of financial and operational data. Due to the complexity of logistics processes increasingly an essential element in the analysis of process is the need to assess the effectiveness of simulation that allows you to identify all the factors that influence the value of each indicator. The problem with developing a comprehensive set of indicators to assess the efficiency of logistic processes causing numerous discrepancies in their application, and methods of determining.

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