MODEL OF ASSESSING THE LOGISTICS OPERATORS IN SUPPLY CHAIN

KULIŃSKA Ewa[1]

Opole University of Technology, Department of Production Engineering and Logistics, Faculty of Logistics, Opole, Poland, EU
e.kulinska@po.opole.pl;

Abstract

The aim of this article is to demonstrate the importance of the reliability of the selected links of the logistics chain. For companies operating on the steel market, this means the need to develop new terms of cooperation based on different segments of customers. Logistics operators are those links that fall within the structure of efficient logistics chains. In order to meet market expectations, steel plants must be in possession of the tools to verify the different links forming part of their respective logistic chains.

To verify the research objective, the following theoretical tools were used: analysis, synthesis, generalizations, comparisons. In terms of practical methods, the following found application: observation method (collecting information about the partners in logistics chain, interviews with employees, determining interferences within and between the links) as well as calculation method and Delphi method.

The article, based on the research conducted in the selected links of the logistics chain of the steel industry, has shown model of assessing the logistics operators in supply chain. A method of evaluation of logistics operators was proposed, with the aim of minimizing interferences in the chain.

Keywords: Logistics chain, steel market, logistics operators, Delphi method for evaluating logistics operators

1. INTRODUCTION

Logistics operators are those links that fall within the structure of efficient logistics chains. In order to meet market expectations, steel plants must be in possession of the tools to verify the different links forming part of their respective logistic chains.

Interference can be defined as an event that is either expected or not, causing unplanned, negative deviations in the process of supplying products and the services carried out in accordance with the objectives of the organization [10]. The term interference relates to both the occurrence of an adverse effect as well as the consequences it entails. The majority of discussions concerning interferences in the logistics literature refers to the definition of risk in logistics processes. Risk means the existence of risk factors specific (typical) for logistics processes, having a certain probability (frequency) and causing certain effects (expressed in terms of costs). Risk factors in the logistics processes affect changes in the added value fulfilled by the primary processes of the organization. This change is most often negative [7]. The relationship between threat, adverse event and risk is explained in the literature as follows: operation in hazardous conditions exposes the entity to the occurrence of an adverse event (interference), although not necessarily; likely occurrence of an adverse event (interference) that will entail consequences means risk.

For example, a threat may be cooperating with an unreliable provider, an adverse event (interference) will be non-receipt of on-time delivery, and risk will be the likelihood of the company not receiving on-time delivery and the impact of this fact on its objectives [11].

As the interest in various forms of cooperation in the logistics chain increases, there are studies showing inter-organizational relations as one of the sources of interferences causing deviations in the logistics and production processes [9].

The implementation of various concepts of management, enhancement, quality improvement etc. of logistics processes, including those related to reducing logistics costs, increases susceptibility of logistic chains to any kind of interference.

Interference in the logistics chain can be anything that affects the flow and supply of raw materials, constituent elements, components and finished products at any stage of the flow from the source of origin to end points where there is a demand. [8]. R Handfield, K. McCormack define interference as major delays in production, distribution or supply nodes, that have consequences on the performance of other nodes of the supply chain [3]. Interferences are usually the bottleneck in one of the nodes that spreads along with its consequences to the entire supply chain. Every single event - such as fire, quality issues with manufactured goods, machinery failure, delayed customer orders - may trigger significant interferences throughout the logistics chain [6].

In the more complex supply chains, i.e. those where there is a lot of nodes, the number of potential interferences increases accordingly. Efficient and effective management and cooperation in such a logistics chain requires, first of all, identifying those nodes that are most vulnerable to the consequences of extraordinary events and are critical links from the standpoint of the chain as a whole These include, inter alia, logistics operators providing transportation and storage services.

2. USING THE DELPHI METHOD TO ASSESS OF THE LOGISTICS OPERATORS

The study began with the development of a catalog of probable interferences that should be considered when recruiting new partners of the logistics chain of the steel industry. Based on the well-established method of score-based evaluations of suppliers, a method of point-based evaluation of the logistics chain partners was developed, taking into account measurable factors that may contribute to the occurrence of interferences.

The choice of partner in the logistics chain is a complex task since not all factors influencing this decision are measurable in economic terms. Helpful in such cases is the Delphi method (relying on a panel of experts) which implements opinions and evaluations of deliberately-opted experts. The basis of experts' considerations of is to analyze selected factors that can be measured or at least comparatively assessed. Based on the literature sources [11, 12], an algorithm for selection of suppliers was developed. This algorithm consists of the following stages:

Stage 1. Determining the set of potential providers of logistics services in the field of transportation and / or warehousing. Analysis of logistics operators' offerings and their initial selection allows for choosing a couple of potential operators. It is, of course, assumed that after the initial selection, there is still a choice, i.e. that at least two potential operators remain, whose expertise with regard to logistics infrastructure and organizational capacity meet the requirements of the logistics chain in question and who enjoy positive reviews on the market.

Stage 2. Determining the evaluation criteria. The starting point is to select those criteria that are important for the partners of the logistics chain and are to some extent measurable, comparable with each other. They will form the basis for establishing parametric evaluation criteria. based on the criteria determining the choice of operator / operators. On the basis of the research conducted, the following criteria were determined:

- Information flow between the logistics operator and links of the logistic chain
- Timely delivery / timely availability of storage spaces, warehouses
- Completeness of deliveries
- Occurrence of failures
- Occurrence of accidents
- Service quality (correct shipping documentation, handling complaints).

Stage 3. Determining the scoring rules in relation to specific criteria. Each of these criteria was awarded 0-100 points, adding reference points to allow for proper evaluation. The data is contained in **Table 1**. Scoring

individual criteria may be the result of evaluation and experiences of the evaluator, as well as the offerings of individual operators. The evaluation can be made together or separately for transportation and warehousing services, in accordance with the criteria specified in offering-related requests.

Table 1 Data collection for assessing the partners of the steel plant's logistics chain

Evaluation criterion	Factors that may cause interference	Criterion score
Information flow between the logistics operator and links of the logistic chain	Form of order placement Website Response time to e-mails, phone calls Completeness and accuracy of documentation GPS or other system Possibility of shipment tracking	100 - without reservations 50 - in the case of deviations in some or all forms of communication 0 - no contact
Timely delivery / timely availability of storage spaces, warehouses	Processing orders Reliability in meeting deadlines Distance of the logistics operator from individual (or selected) links of the logistics chain Arrangement of working time Route-planning	100 - right on time 100 - (x * number of days after the deadline); x - depends on the parameter of evaluation. Cases where the operator has warned about the change of date should be analyzed separately.
Completeness of deliveries	Bad loading in terms of quantity and material Loss of goods during transportation (bad packaging) External theft Internal theft Loading inability Unloading inability	100 - deviation up to 10% 80 - deviation of 11 - 20% 50 - deviation of 21-50% 20 - deviation of 51 - 80% 0 - deviation exceeding 80%
Occurrence of failures	Vehicle breakdowns Failure of loading and unloading equipment Drivers' sickness	100 - deviation up to 10% 80 - deviation of 11 - 20% 50 - deviation of 21-50% 20 - deviation of 51 - 80% 0 - deviation exceeding 80%
Occurrence of accidents	Number of accidents per service expressed in time unit	100 - deviation up to 10% 80 - deviation of 11 - 20% 50 - deviation of 21-50% 20 - deviation of 51 - 80% 0 - deviation exceeding 80%
Service quality	Covering costs of transportation/warehousing, storage Handling complaints Shipping documentation Willingness to maintain inventories Assistance in difficult situations	100 - high level 80 - satisfactory level 50 - acceptable level

Source: own study.

Stage 4. Determining the scales for each criterion. The evaluation criteria may have different meanings for the steel company. For this reason developed was a scale system that accentuates these criteria that a given

company deems to be the most important, and lowering scales of the other criteria. Proposals of these scales are shown in **Table 2**.

Table 2 Data collection for assessing the partners of the steel plant's logistics chain

Evaluation criterion	Criterion scale	Criterion score
Information flow between the logistics operator and links of the logistic chain	0.3	100 - without reservations 50 - in the case of deviations in some or all forms of communication 0 - no contact
Timely delivery / timely availability of storage spaces, warehouses	0.15	100 - right on time 100 - (x * number of days after the deadline); x - depends on the parameter of evaluation. Cases where the operator has warned about the change of date should be analyzed separately.
Completeness of deliveries	0.15	100 - deviation up to 10% 80 - deviation of 11 - 20% 50 - deviation of 21-50% 20 - deviation of 51 - 80% 0 - deviation exceeding 80%
Occurrence of failures	0.1	100 - deviation up to 10% 80 - deviation of 11 - 20% 50 - deviation of 21-50% 20 - deviation of 51 - 80% 0 - deviation exceeding 80%
Occurrence of accidents	0.1	100 - deviation up to 10% 80 - deviation of 11 - 20% 50 - deviation of 21-50% 20 - deviation of 51 - 80% 0 - deviation exceeding 80%
Service quality	0.2	100 - high level 80 - satisfactory level 50 - acceptable level
∑	1	

Source: own study.

The total scale of the criteria is 1, the scales are assigned separately for each criterion from 0 -1, assuming that those considered to be most important have a high rank, and those of lesser importance - low rank.

Stage 5. Rating logistics operators according to the criteria and calculation of evaluation rates. The primary source of information used by the experts in the evaluation of the operators is the conditions required for offering-related requests. This audit should be carried out before the formal signing of the contract with the operator, and the results should be recorded. The audit should also involve the employees of organizational units of the company (Warehouses, Quality Control Department, Purchasing Department, Production Departments) [4]. The results of the calculations of the evaluation are carried out based on Formula (1):

$$Ki = Oi * Wi \quad (1)$$

Ki - evaluation criterion
Oi - criterion score

Wi - criterion scale

Stage 6. Analysis of the results of calculations and selection of a logistics operator. The latter is determined by the highest total score calculated on the basis of evaluation rates. The choice proposed by the experts based on these criteria - albeit difficult to be precisely (mathematically) grounded - is nevertheless objective. It is difficult to exclude the possibility that the decision regarding the selection may also be influenced by subjective reasons (immeasurable or partially measurable), e.g. informal relations between companies' management that stem from the beneficial effects of cooperation. The decision of choosing the supplier made solely on the basis of these criteria must be confronted with marketing activities and market strategy of the company.

Stage 7. Preparation of evaluation sheet concerning the logistics operator. In many companies, such sheet is drawn up for each potential supplier and the same sheets can be made when choosing a logistics operator. These sheets, apart from possibly full technical and economical address information, contain results of the scoring evaluation as well as the overall result of the evaluation. One can also specify the number of points qualifying or disqualifying a logistics operator for cooperation. A sample evaluation sheet will be presented in the case study conducted for *Huta Małapanew* in Ozimek.

The presented method and the criteria for selection of logistics operators should be treated as an inspiration to seek one's own solutions to the specifics of the logistics chain.

3. APPLICATION

In the company, the logistics operators of the *Huta Małapanew* steel plant were assessed. The study involved 12 experts (employees of the Department of Logistics) from the Opole University of Technology. After the initial selection, taking into account the criteria that were of interest to the company. selected were 2 potential logistics operators denoted in the publication as A and B.

Table 3 Score method of evaluating partners of the steel plant's logistics chain

Evaluation criterion	**Scale *Wi***	**Logistics Operator A - Evaluation *Oi***	**Logistics Operator B - Evaluation *Oi***	**Logistics Operator A - Evaluation rate *Ki***	**Logistics Operator B - Evaluation rate *Ki***
Information flow (…)	0.3	70	55	21	16.5
Timely delivery / timely availability of storage spaces, warehouses	0.15	80	90	12	13.5
Completeness of deliveries	0.15	80	95	12	14.25
Occurrence of failures	0.1	50	80	5	8
Occurrence of accidents	0.1	85	85	8.5	8.5
Service quality	0.2	70	85	14	17
∑	**1**			**72.5**	**77.75**

Source: own study.

Stage 2 Assessed Criteria: information flow between the logistics operator and links of the logistic chain, timely delivery / timely availability of storage spaces, warehouses, completeness of deliveries, occurrence of failures, occurrence of accidents.

Stage 3 Adopted was the score specified and Stage 4 Adopted were the scales specified and Stage 5 Evaluation calculating evaluation rates - see **Table 3**.

Stage 6 After analyzing the obtained results of the evaluation, the team opted for Logistics Operator B
Stage 7 Preparation of the logistics operator's evaluation sheet and entering on the list the logistics operators cooperating with the plant

4. CONCLUSION

The publication, based on the study and mostly on interviews with the employees, has shown that the piling-up of issues in one partner generates issues with other partners. This results in an additional increase in costs and longer time to remove and restore the stability of the production and logistics system.

The research accounted for the factors contributing to the occurrence of interferences and used them to develop - based on the Delphi method - the method of evaluation of logistics operators before establishing cooperation with them, and also to verify the currently cooperators in the logistics chain in order to identify those of them whose performance makes the number of interferences in the implemented logistics chain exceed the acceptable level, essential for key partners.

Controlling parameters such as quality and safety of cooperation with logistics operators reflects in the quality of the implemented logistics processes and consequently in the quality of final products, in this case steel.

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