

ASPECTS OF RISK MANAGEMENT IN LOGISTICS ACTIVITIES OF ENTERPRISES. APPLICATION OF FAULT TREE ANALYSIS (FTA)

НЕКОТОРЫЕ АСПЕКТЫ УПРАВЛЕНИЕ РИСКАМИ В ЛОГИСТИЧЕСКОЙ ДЕЯТЕЛЬНОСТИ ПРЕДПРИЯТИЙ. ПРИМЕНЕНИЕ АНАЛИЗ ДЕРЕВА ОТКАЗОВ (FTA)

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Abstract: Risk management in logistics enterprises is one of the important topics in the management of supply. In today's global reality characterized by constant and rapid changes that make high degree of uncertainty and risk, make the logistics activity critical.

The purpose of this article is to present the main aspects of risk management including the construction of the risk profile in logistics activity in enterprises and demonstrate the applicability of the FTA, which was developed conditional example. This will considerably facilitate efforts directed at risk management in logistics activity in enterprises.

KEYWORDS: RISK MANAGEMENT, LOGISTICS, LOGISTIC ACTIVITY, FTA

1. Introduction

For many enterprises, the traditional operational strategies directed to "stock" setting up and investments in buffer capacities, that will take the high initial demand, cannot match the business environment and to be competitive. That motivates the enterprises to direct their efforts to search and apply strategies that will create an opportunity for quick and adequate reaction of the changes in the business environment and at the same time the expenses are reduced to a minimum [1].

The risk assessment in any activity as well as in the logistic management is a key element and has a determinant role for the way of functioning and the competitive power in particular and for the enterprise as a whole.

2. Presentation

2.1. Key role of logistics in business management in the dynamics of the modern business environment

The modern dynamics of the business environment, considerably exalted in result of the world crisis, places new outlines in the global world. New economic sectors are formed as a result of new demands and preferences as well as different consumer values. The adaptation of the enterprises to all these changes is turning to be a critical stage in their management. The growing variability of the business environment is getting so big that it is impossible to predict. In addition to that the new risks coming into existence create huge risk for the enterprises as well as high insecurity in their operations.

Keeping the dynamic balance between the way of functioning of the enterprises and the requirements and characteristics of the business environment as well as creating of competitive privileges is getting more and more difficult goal [2].

Along with the already mentioned above, another two factors for the modern business cannot be skipped, and they are time and space where the connection between them is the logistics.

The logistic itself is defined as one of the main competitive privileges. For instance – Martin Christopher, [5] defines the effective management of logistics and chain of supply as a main resource of competitive privilege – which means the position of having a long upper hand of the consumer's preference among the competitors can be achieved by better logistic management and chain of supply.

On figure1 is presented a simplified model of the enterprise, consumers and competitors or the so called the 3 C's – the three ways of interdependence between them [5].

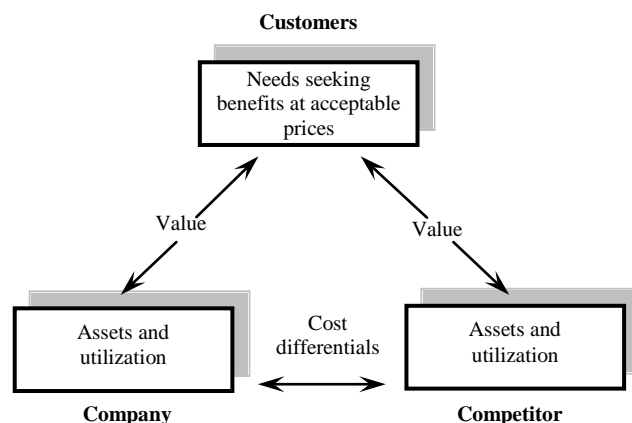


Fig.1 Competitive advantage and the "Three Cs"
(Source: Ohmae, K., *The Mind of the Strategist*, Penguin Books, 1983)

According to Martin Christopher [5] the resource of competitive privilege is detected in first place in the ability of the enterprises to determine themselves from the consumers and the competitors and in second place – operating by less expenses to generate higher profit.

Gleissner and Femerling [6] define the logistics as a competitive instrument and means for rationalization.

In that way the logistic services can generate different opportunities for strategical competitive privilege. On the other hand, the good organization of the logistic systems can develop the potential of rationalization that can give a stable competitive privilege of the enterprise.

According to Harrison and van Hoek, [7], you need to clearly set the goals and their essentiality and measurability so you can clearly define the logistic privileges. Basically three "firm goals" are dissociated - quality, time and price. Later on they determine two main ways of logistic privilege formation and the variability in the logistic process and managing the vagueness - they are called "supportive capabilities".

The goal and achieving of competitive priorities are in the basis of the enterprises competitive power that is assessed as inner value for any of them and it is connected with certain characteristics. The competitive priorities and all

factors of the same character are very dynamical and the way of getting them stable in the modern dynamics of the business environment must be directed to searching a broad complex of different processes and activities connected to quality, reliability, price, speed including manufacturing and distribution.

Logistic management as a management of the whole flow of products, information, people, financial resources etc... must keep close connection with the whole complex of activities and processes. The high coordination and harmonization in management of the logistic process together with the rest of the activities and processes in the enterprises is in the basis of high loyalty creation to the customers and in the basis of achieving stable competitive privileges.

2.2. Risk profile and risk profiling in management of the logistic activity.

The large and quick changes in the business environment put in central stage the topic of risk and risk management. The risk management is an essential key element exerting extreme influence on the activity of the enterprises. They cause different risk situations because of their complicated nature.

The possibility of identifying and evaluating the risk situations is in the basis of adequate reaction and respectively adequate management that can minimize the risk results e.g. decreasing the loss amount, opening new opportunities etc. This means it decreases the potential negative risks and increases the potential of the positive risks and the buffer effect when you can't avoid the risk situation. In that way "taking the risk" creates an environment for the enterprise to cope with the negative influence (fig.2).

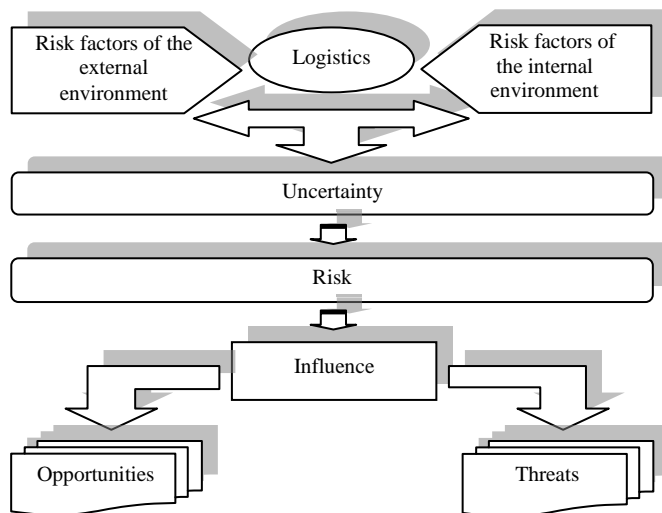


Fig.2 Risk resource and influence

The global factor and the permanent development of the information technologies constantly change and create a completely different way of functioning of the logistics and the logistic systems. They create new structures of competition, communication, manufacturing locations etc...

Risk management in the logistic activity in the enterprises has a huge impact on the way of functioning and the competitive power. In 2011 Aon Global Risk Management Survey [4] records „supply chain failure” as

one of the top three risks shown by the respondents in the industries – biotechnologies, pharmaceuticals, consumer’s goods, machinery and equipment and non-aviation transport.

The large risk variety in different types of business are typical in the logistic activity as well , like financial risks, transport risks, outsourcing risk, political risks etc...

Determining of the risk profile that has an effect on the “risk exposition” in certain period of time is of a great significance for reaching an effective risk management. Defining the separate risk groups, specific risks as well as their potential effect – their probability and consequences connected with the logistic activity, afford an opportunity for defining the target risk profile or the so called “desired” risk profile. This determining will be connected with the risk appetite, the set goals, the method of management etc... For instance, if we look at logistic macro-model that consists of three main components – supply, manufacturing and distribution, we can define the four main group risks – business environment, consumers, products and services , raw material suppliers(fig.3).

Based on the risk analysis we can create a risk profile where the accent will be directed to all key risks and risk areas of this activity, strengths and weaknesses, opportunities, risk tolerance guideline, priority set up etc... It is important to be highlighted that forming of a significant risk profile is a major step to forming of an integrated risk management.

In that way the risk management in the logistic activity will be connected with “constant” correction in the current risk profile, i.e. risk defining (risk groups, specific risks etc...) that has high influence and effects and will be directed to different ways of decreasing. This will form the so called “desired“ risk profile.

In result of development and defining of the risk profile the threats will be identified as well as the logistic activity possibilities and guidelines for building of effective risk management strategies.

2.3. Application of Fault Tree Analysis (FTA) for risk rating in the logistic activity

Fault tree is a graphic method that can make a quantitative risk analysis in different stages of the activity e.g. in the process planning stage, in the operation stage etc... Here this method will be applied in a different way and it is risk analysis in the logistic activity.

On the basis of presenting the separate reasonable factors and logic connection along with the identified event (“top” event) a quantification can be done for the possibility that it will be realized (fig.4). This allows thorough understanding of the logistic activities and revealing of the events that lead to risk realization.

FTA application consists of consecutive stages and is exemplified by model example. The example illustrates some possible situations related to the raw material supply.

First stage. Determination of the main event

In the example the main event related to the raw material supply is “Delay of delivery”. On this basis a graphic model of the lowest level events is built up and it is showing the link between the separated elements related to the main event.

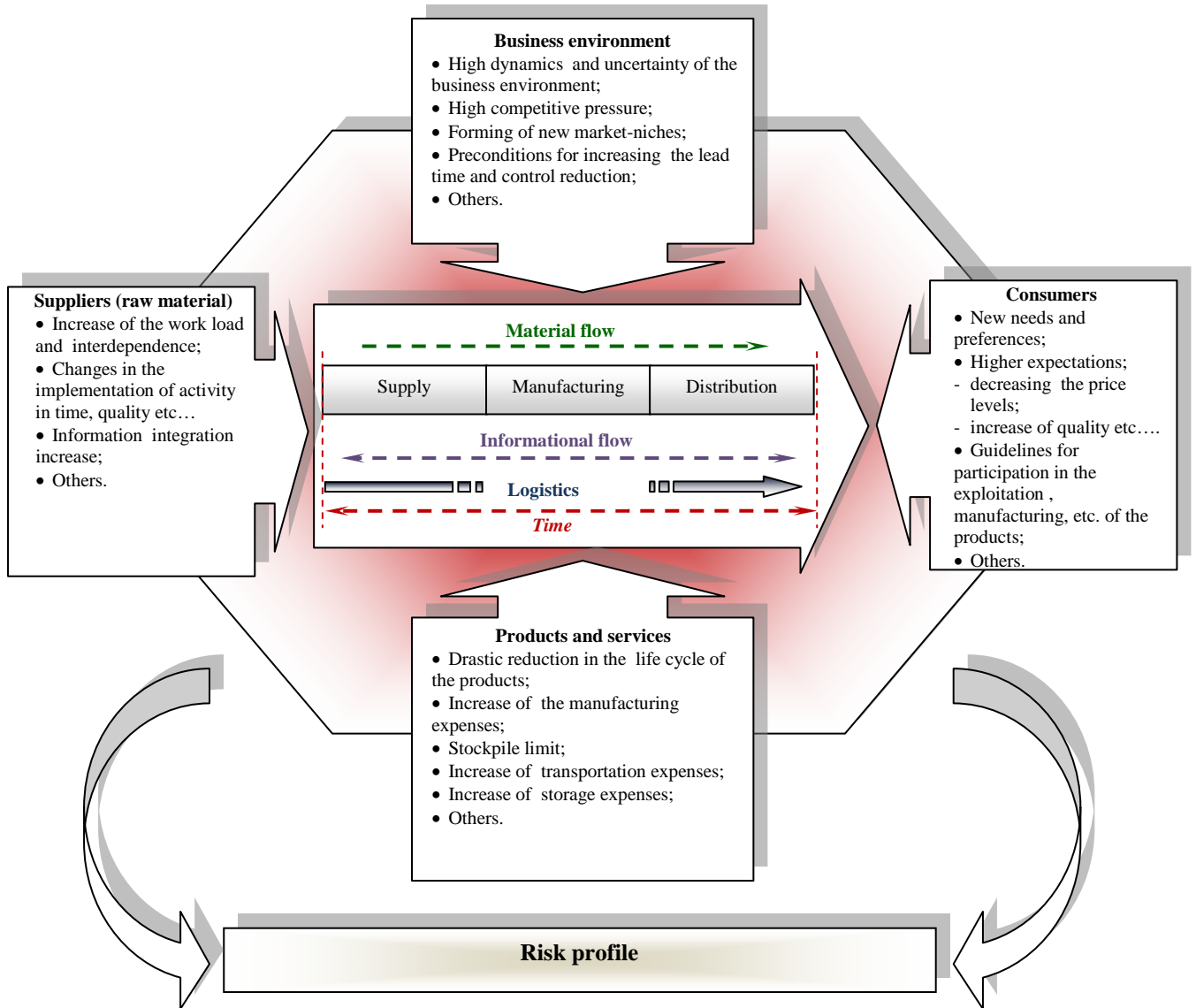


Fig.3. Risk profile set up in the logistic activity

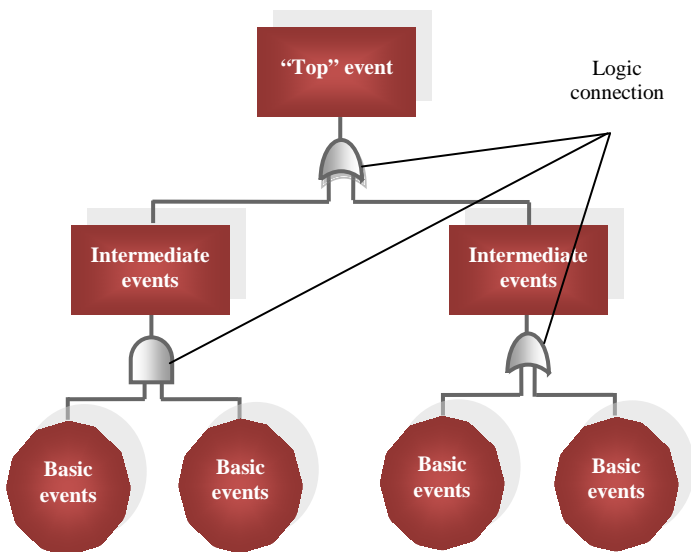


Fig.4. Fault tree

Second stage. Identifying the reasons leading to the main event

A few possible reasons are shown (possible situations) that are related to the main event realization, like:

- Incorrect specification of the raw materials – inaccuracy in the raw material description, inaccuracy in the date of order;
- Incorrect determination of the time between initiation and realization of the order or the so called “lead time” – determination of unreal time of delivery, omission in lead-time delivery overview;
- “Problem” with invoicing - incorrect invoicing, invoicing delay.

On the basis of these two stages we can set up a graphic model showing the links between the separate “elements” with the main event (fig.5).

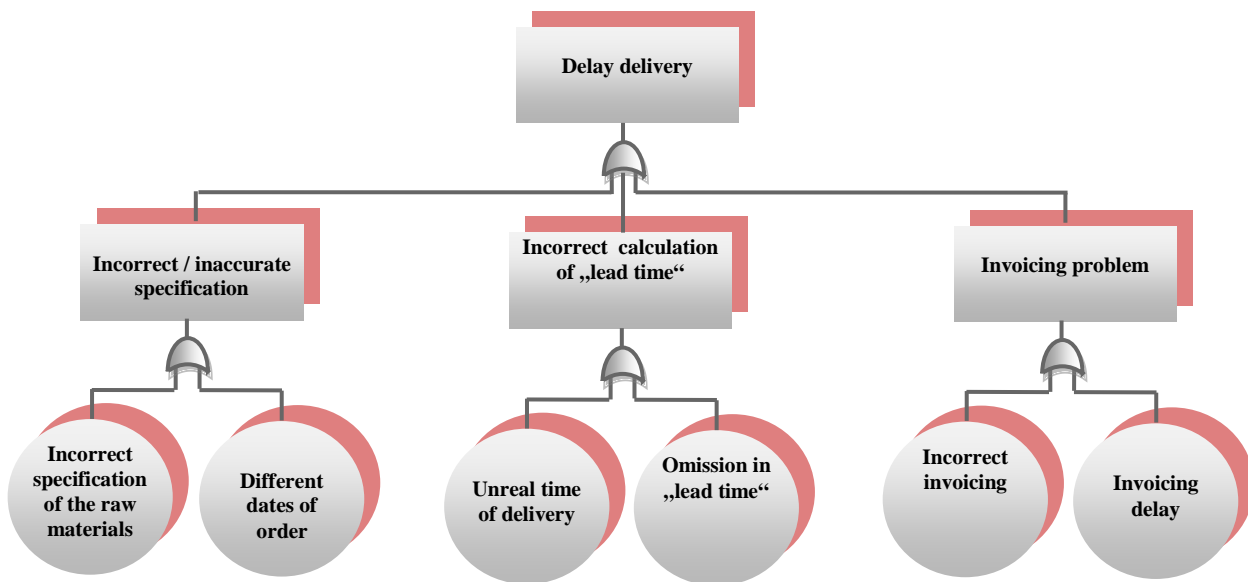


Fig.5 Fault tree of delay delivery

In this case the logistic operation between the separate “elements” will be “or” because every separate activity will lead to risk realization at higher level.

Third stage. Determination of the possibility of every separate event

The possibility determination begins with the main event and in the example given it can be determined on the basis of statistic data for certain period of time.

For example, if we have “inaccuracy” in the raw material inventory in a month for 10 out of 50 orders, the possibility for accuracy is 0.8, respectively the possibility for inaccuracy is 0.2. For the rest of the parameters::

Different dates of order – 0.55 (0.45);

Unreal time of delivery – 0.45 (0.55);

Non-inspection of lead time – 0.35 (0.65);

Wrong invoicing – 0.90 (0.10);

Delay invoicing – 0.70 (0.30).

Forth stage. Determination of the possibility for delivery delay

To determine the possibility of delivery delay we need to determine the possibilities for any of the intermediate events on the basis of the main events. Having in mind the logistic operation “or” and determination of the separate event’s possibility, the possibility of delay delivery event can be determined by calculation of “negative event” from one:

$$P = 1 - \prod_{i=1}^n (1 - P_i) \tag{1.1}$$

Where:

P – in this case – possibility that the delivery will not be delayed;

P_i – in this case – possibility of accuracy of the examined situations, i=1,...,n,

In the first case we will begin with calculation of the possibility that there is no “incorrect” specification of the raw materials where the intermediate event eventuates from two main events: inaccuracy in the raw material specifications and inaccuracy of the date of order. Using formula 1.1 we have:

$$P = 0,91$$

Respectively for the possibility that there is no “incorrect” calculation of lead time where the intermediate event eventuates from two main events: unreal time of delivery and omission in lead time we have:

$$P = 0,64$$

For the possibility that “there is no” problem with the invoice, where the intermediate event eventuates from two main events: wrong invoicing and delay invoicing, we have:

$$P = 0,97$$

Therefore, in this example, on the basis of the calculations made, the possibility that *there will be no delivery delay is*: 0,99, i.e. the risk is 0,01.

The demonstrated method of risk evaluation in the logistic activity has many priorities like high flexibility and this gives opportunities for analysis of many factors and possible situations. The realization of top-down method allows us to focus our attention to all negative events connected to the main event.

3. Conclusion

Risk management is of main importance and a key stage of the activity of any enterprise. The few aspects that are examined are connected with the risk and its evaluation. They affect the risk profile and the risk profiling and are in the basis of effective risk management

in the logistic activity of the enterprises. This gives opportunities for the enterprises in the logistic departments and this leads to construction of effective strategies and their management. The demonstrated method of risk evaluation by adapting the FTA technique in the logistic activity gives an opportunity for considerably deeper analysis and evaluation of the risks in the examined sphere.

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