

risk assessment, risk management,  
supply chain, logistic operators, quality

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## EVALUATION OF RISK MANAGEMENT STATUS FOR CROATIAN LOGISTIC OPERATORS

**Summary.** Understanding organisational risks makes possible to control them and to change them into organisational strengths. Being known as “measure of uncertainty” in the business process, the risk is the uncertainty of achieving the organizational objectives. It may involve positive or negative consequences. There is a level of uncertainty in every supply chain while operating transportation and warehousing, positioning on the market, developing customer support, reducing cycle times or cutting costs. Therefore, the risk assessment should be one of the main tasks for any supply chain management team. It is required to develop formal risk assessment procedures, to identify the potential impacts to the supply chain operations and to develop a set of contingency plans to mitigate risks. This paper deals with supply chain risk assessment methodology, outlining the present risk management status of Croatian logistic operators.

## ОЦЕНКА СОСТОЯНИЯ РИСКА МЕНЕДЖМЕНТА ДЛЯ ХОРВАТСКИХ ЛОГИСТИЧЕСКИХ ОПЕРАТОРОВ

**Аннотация.** Понимание организационных рисков дает возможность их контролировать и преобразовывать их в организационные усилия. Известный как "мера неопределенности" в бизнес-процессе, риск является неопределенностью в достижении организационных целей. Это может иметь положительные или отрицательные последствия. Существует уровень неопределенности в каждой цепочке поставок при операциях транспортировки и складирования, позиционирования на рынке, разработке поддержки клиентов, сокращении времени цикла или сокращения расходов. Таким образом, оценка рисков должна быть одной из основных задач для любой управленческой команды в цепи поставок. Это требуется для разработки формальных процедур оценки рисков, с тем, чтобы определить потенциальные последствия для операций цепи поставок и разработать несколько резервных планов по снижению рисков. Эта статья посвящена методологии оценки риска в цепи поставок, с изложением современного состояния управления рисками у хорватских логистических операторов.

### 1. INTRODUCTION

Logistic approach involves different processes, resources, time and geographical area which have been widened by shifting production to the Far East. Every organization is subject to certain risks

while running its activities, which may disable it in reaching its objectives. Setting an effective risk management strategy will improve the chances of realizing assigned goals and objectives. Organizations that apply risk management are generally able to benefit from being less exposed to uncertainty in the environment.

Information is the most important driver of the supply chain. Supply chain management is based on the accurate information which must be available in the right form and at the right time. The right time is crucial, as the process triggers are synchronized in that way. Delayed information, combined with uncertainty risks, almost always lead to some kind of disruption or bottlenecks in the supply chain.

All aspects of any company business lies more or less on logistics so any disruption in it can cause disruption in customer satisfaction, loss of profit, or loss of business. Just in time concept and lean theory that is core in logistics plans, direct depends on strength of the weakest loop in logistic network chain. Logistic is based on planning. Because of its network structure, any step or activity that is planned has to be coherent, in order to provide the logistic scope. So, discrepancy in just one step can affect the whole chain and can cause logistic to become inefficient. The best way to deal with possible discrepancy and vulnerabilities is to know in advance what can happen and how to deal with it when it happens. Risk can be characterized by both the probability of an event and its severity given that an event occurs. In the supply chain risks or disruptions are not only increasing in frequency, but also the severity of their impact can be costly and potentially bring portions of the supply chain to a complete halt. According to quality systems, which are a trend in logistics companies, risks assessment is a part of quality control and assurance. A well known quality circle of Plan, Do, Check, Act, asks from an organization to deal with different deviations, search for roots of deviations, measure those deviations, and to plan its activities in a manner to avoid less quality caused by deviations. Measuring and analysing of quality involves among other issues, customer satisfaction and company losses and profit. In just these two things influence of risks can be noticed and it can be understood why quality and safety in any aspect of organization business can not be separated.

## 2. FORMAL PROCEDURES OF RISK ASSESSMENT

When planning core logistic activities, it is advisable to take into account the risk effects. A risk is an issue arising out of the uncertainty which results from any activity, regardless of the size or the challenge. It is a wide concept that differs from the element commonly known as a threat. Minor issue can be identified as a risk. Difference between a risk and a minor issue is that the risk can be broken down into three elements:

- the event itself,
- the impact and
- the consequence.

Anything what can cause project to fail is a way to describe a risk. Risk can basically be defined as a possibility that a specific action or situation can bring about adversity which blocks an organization from reaching its objectives. It can be characterized both by the probability of an event and its severity given that an event occurs, [1]. So the risk can be quantified by a set of functions, as shown on figure 1.

Amplifiers of risks can be defined as a characteristic that increases the probability of a disruptive event. An example of amplifiers can be instability of supplier's environment, length of lead time, clustering of suppliers, degree of customer regulations, and number of transfer points, quality requirements, and potential for terrorism. All possible disruption amplifiers can be classified into one of two categories:

1. the extent to which a company relies on sources of supply or
2. the number of constrained dependencies.

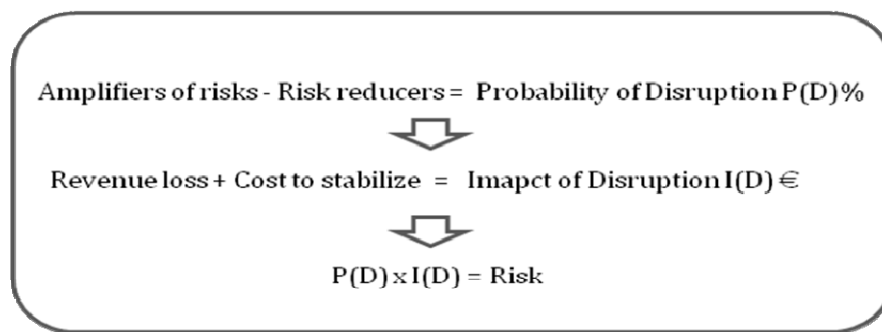


Fig. 1. Quantification of risk

Рис. 1. Количественная оценка риска

### 3. RISK REDUCTION MECHANISMS

A variety of different risk reduction mechanisms can be identified by the logistics companies. Probably the most important mechanisms are those which can provide the ability to discover that a disruption has occurred and the ability to establish plans to effectively recover from the disruption. Once a disruption occurs, the first critical action is to recognize it and to deploy mitigation effort. And many companies fail to recognize that a disruption has even occurred. The elements of risk reduction are:

1. excessive resources,
2. supply chain planning and collaboration,
3. information visibility and
4. supply chain redesign.

Excessive resources reduce the time between disruption discovery and recovery while supply chain planning and collaboration ensures that the design of the supply chain is made more robust to reduce the probability of these events to occur again. Improved information visibility reduces the time between the disruption and its discovery, and reduces the impact of the disruption while supply chain redesign involves a significant investment in product or process redesign to reduce risk.

### 4. RISK MANAGEMENT

Dealing with risks, organizations introduce a risk management. The risk management is a program that includes the processes of identifying the risk, quantifying the risk, assigning responsibility for management of the risk, and risk mitigation actions. It can be done on a company-wide basis but is often done on a site basis because one wants to examine the risk of disruption to production and distribution processes. This is the level of detail needed to diagnose the root causes of disruptions effectively. A method that organizations can use to manage risk is to make use of risk registry, [5]. The risk registry can be constructed through the usage of a four step method:

1. **Identifying the risks** – at this step it is important to discuss potential risks with those who are familiar with it, to use resources and analyse reports, including financial or application reports.
2. **Evaluating the risks** – after risks have been properly identified, it is important to analyze the possible impact that could occur as a result, as well as its chances of occurring (measured the probability and impact of any potential risk occurring). This step is something like making “risk profile “ for risks and prioritization. The risks matrix used for this purpose is shown on figure 2.
3. **Treating the risks** – depends on nature and kind of risks. Some risks can be overcome by organization itself. In this step it is necessary to set contingency plans to mitigate risks. Nature of risks can be described by acronym STEEP which stands for Social, Technological, Economic, Environmental and Political. Under this scope there are different kinds of risks: strategic risks,

financial risks, process risks, intangible risks, time risks, human risks, legal risks, physical risks, and hazard risks. Financial risk is the loss of funding or key resources. Process risk involves risky business processes that could lead to project failure. Intangible risks are often associated with any damage that is done to the reputation of the brand of the organization. Time risks are risks which often involve things connected to time, such as delays or opportunity costs which are missed. Human risk involves all risks which are connected to humans, such as the loss of crucial employees or knowledge. Some of risks if planned properly can be controlled, managed or mitigated while some will be beyond organization's influence. Legal losses include government regulations, regulations which have an adverse impact on operations of a company. Physical risks involve the loss of physical resources, and can include things such as equipment, buildings, or land. Disasters, whether they are man made or natural, are the gravest threat to physical resources.

4. **Monitoring and analyzing risks** – once defined, risks have to be monitored and analysed constantly. Reviews of identification of risks have to be repeated as well as all other steps. The things learned from any given project have to be distributed to other projects, which can be done by the use of risk registry. This process is best described by the Japanese word *yokoten* which can be translated as *one place to another*, meaning that information from one project is immediately transferred to other projects.

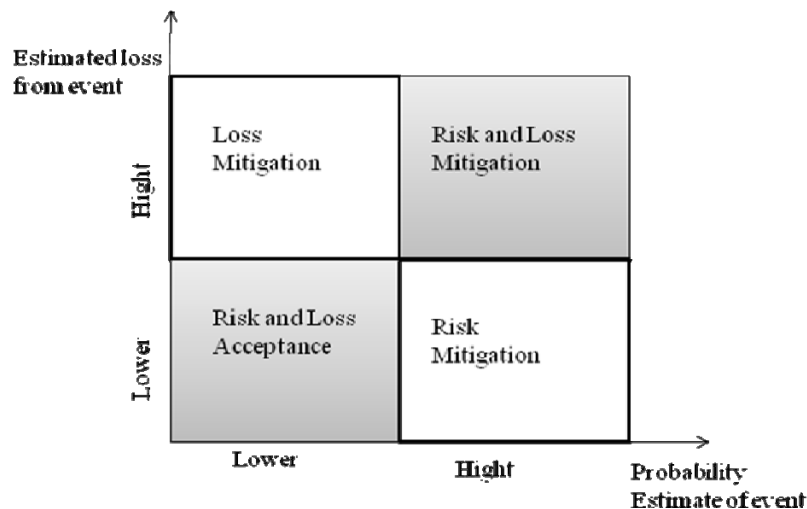


Fig. 2. Risks matrix  
Рис. 2. Матрица рисков

Once the risks registry is created, risk management procedures should be to plan risks, risk assessment, risk mitigation and risk monitoring, as well as checking and updating risk registry. Planning risks means to count risk affect in logistics plans. A risk assessment identifies and quantifies the risk of a supply disruption using a framework that describes attributes of suppliers, their relationships, and their interactions with the company performing the assessment. A typical framework consists of several dimensions:

1. Relationship factors (influence, levels of cooperation, power, alignment of interests, etc.)
2. Past performance (quality, on-time delivery, shorts, etc.)
3. Human resource factors (unionization, relationship with employees, level of pay compared to the norm, etc.)
4. History of supply chain disruptions (is the network prone to disruptions?)
5. Environment (geographical, political, shipping distance and method).
6. Disaster history (hurricane, earthquake, tornado, flood, etc.)
7. Financial factors (ownership, funding, payables, receivables)

A set of measures (questions to be answered) should be developed under this framework, completed with scales that apply to the category, and validated by management. These measures and

scales are used then to evaluate a supplier or a node and provide a numerical score for each supplier or a node that reflects the risk of a disruption involving that supplier. A risk profile can be of a supplier, a group of suppliers, or of a supplier network (multiple tiers of suppliers brought together for a purpose). Or it can be shown as a risk profile of a node, groups of nodes, or part of a network. This profile is usually a numerical score given as a result of applying the framework and measures. Normally, the higher the score, the higher the disruption potential of the entity being measured. The risk assessment model measures the risk-associated characteristics of a company's supply chain based upon dimensions mention before.

## 5. DEFINING RISKS

Assessment of risks is a way of determining how to tie together different types of data that can be identified in logistics operations. Logistics operations are exposed to market intelligence as well as business intelligence. Market intelligence and risk assessments are consumed by various functional and business units in the organization, not just strategic sourcing. Some of the major elements of market and business intelligence that impact risk include the following:

- Customer demand (or demand) for the supply input;
- Price (including international exchange rates);
- Competitor (identification and competitive ranking);
- Capacity (resources including technology advancements);
- Technology forecasts;
- Supply resources;
- Regulatory;
- Logistics risk.

At defining risks in logistics network, first step should be to map network nodes at a high level to understand its design and flow of goods. Next, measuring network risk is a function of measuring the probability of a disruption at nodes where there is significant risk, as well as estimating the severity of the impact on the entire network based on a disruption at a single node. Estimating probability of supply chain disruption event is difficult and depends on the environment built by suppliers and customers within a trading network. Once the base probability estimation is completed for network disruption events, specific supplier can be assigned the likelihood of specific event occurring with specific suppliers using the results of a supplier by supplier risk assessment. After collection, the data is then organized into risk categories, representing the different sources of potential supply chain risk.

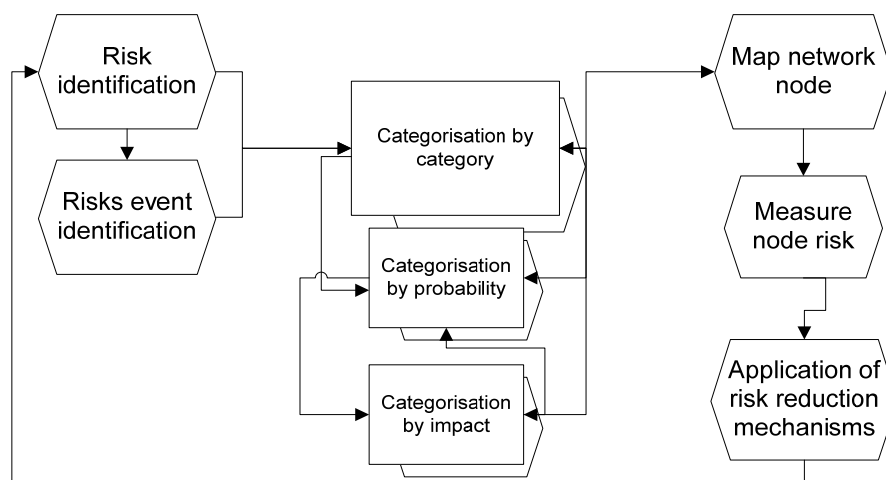


Fig. 3. Defining risks on logistic network

Рис. 3. Определение рисков для логистической сети

Viewing the data by risk categories provides a diagnostic view of the supply network and aids in identifying the attributes that are driving the risk rating and targeting mitigation actions. The data is also organized by risk event. These are the events that might occur that would result in a supply chain disruption. Viewing the data by risk events provides also an analytical view of the supply network and aids in identifying the attributes that are driving the possibility of specific events. This helps in understanding “what” might happen that would result in a supply disruption.

After the assessment data is applied to the risk events, they are then organized by risk category. Viewing the data by risk events that relate to risk category provides an analytical view of the supply network that identifies the sources of risk that are driving the possibility of specific events. This helps in targeting mitigation actions to specific sources of risk in a supplier rather than broad supplier development programs.

## 6. QUANTIFICATION OF RISK

The risk measurements, or indices, are calculated in two paths: diagnostic and analytical. Path one, the diagnostic, is a simple roll-up of assessment scores (indicators) into the respective risk categories. A risk index is then created by averaging all the scores. This risk index reflects the comparative level of risk in the supply chain as it is constructed and managed at the time of the assessment. This measure is used to build ranking of suppliers and commodity groups to determine acceptable levels of risk in the structure of the network itself.

Path two, the analytical mode, is slightly more complex. The assessment scores (indicators) are rearranged according to risk event. A score is assigned to each event based upon the summed actual indicator scores divided by the total possible score. Each risk event has a probability representing the likelihood of that event occurring in a certain product category. The probabilities for each event are then multiplied by the event score, producing a Risk Probability Index (RPI). The average RPI for all events is then calculated. This number represents the event-associated risk potential of a disruption for the supplier assessed.

## 7. RISK MANAGEMENT PRACTISE AT CROATIAN LOGISTIC OPERATORS

The analysis of the operational standards and official procedures at some major Croatian logistic operators has shown they haven't introduced relevant principles of the risk management in their business practise. They deal with some risks issues through quality system, but on rather low level. Several reasons for this situation could be detected:

- The local economy is import oriented, which also decreases the scope of activities of local logistic operators who are mostly oriented on servicing global operators as agents or subcontractors.
- The local operators are expected to adapt to the standards imposed from outside, rather than developing their own solutions.
- The local production is less developed; lean manufacturing hasn't been introduced yet.
- Since the local market is relatively small (comparing to the EU standards), it can hardly generate significant volumes of goods, needed to build up a local logistic industry.
- The requirements set by the local users of logistic services still haven't pushed the operators to develop integrated logistic solutions which would involve principles of the risk management.
- The local logistic operators still haven't been fully exposed to competition beyond the local market, however it is likely to happen in the near future (latest by the time Croatia joins the EU).

## 8. CONCLUSION

Setting an effective risk management strategy improves the prospects of realizing assigned goals and objectives, as the organisation becomes less exposed to uncertainty in the environment. Risk

management is a program that includes the processes of identifying risk, quantifying risk, assigning responsibility for management of risk, and risk mitigation actions. The procedures within risk management involve planning of risks, risk assessment, risk mitigation and risk monitoring, as well as checking and updating risk registry. It is therefore required to develop a formal risk assessment procedure, to identify potential impacts to the supply chain operations and to develop a set of contingency plans to mitigate risks.

Instead of introducing relevant principles of the risk management, Croatian logistic operators deal with risk issues through their quality systems. The structure of the local demand for logistic services still haven't required the operators to develop integrated logistic solutions which would involve principles of risk management. However, this situation is likely to change in the near future (by the time Croatia joins the EU, latest) as well as competition, which is going to take place beyond the local market.

## References

1. Handfield R.B., McCormac K.: *Supply Chain Risk Management*, Auerbach Publication, N.Jersey, 2008, pp. 51-65.
2. Mun J.: *Modeling Risk*, J.Will&Sons, N.Jersey, 2006, pp. 11-68.
3. Neigera D., Rotarua K., Churilov L.: *Supply chain risk identification with value-focused process engineering*, Journal of operation management, No.27, 2009, pp. 154-168.
4. Vorst J., Beulens A.J.M.: *Identifying sources of uncertainty to generate supply chain redesign strategies*, International Journal of Physical Distribution & Logistics Management, Vol. 32 No. 6, 2002, pp. 409-430.
5. Walden J.L.: *Velocity management in logistics and distribution*, Taylor Francis, 2006, pp.213-249.

Received 12.06.2009; accepted in revised form 20.09.2010