

# ПІДПРИЄМНИЦТВО. МЕНЕДЖМЕНТ. МАРКЕТИНГ. ЛОГІСТИКА

## BUSINESS. MANAGEMENT. MARKETING. LOGISTICS

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### METHODOLOGICAL APPROACHES TO LOGISTIC RISKS ASSESSMENT

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*Oklander M.A., Yashkin D.S. Методичні підходи оцінювання логістичних ризиків.*

Управління логістичними процесами передбачає нараження на дію низки факторів невизначеності, що носять випадковий характер. Оперування цими чинниками, що можуть негативно впливати на перебіг нормального господарського обороту в аспекті логістичного обслуговування є задачею ефективних менеджерських рішень, що ставить питання необхідності визначення, класифікації та оцінки логістичних ризиків.

*Ключові слова:* логістичні ризики, оцінка ризиків, оцінка збитків

*Oklander M.A., Yashkin D.S. Методические подходы оценки логистических рисков.*

Управление логистическими процессами предусматривает подвергание на действие ряда факторов неопределенности, которые носят случайный характер. Оперирование этими факторами, которые могут негативно влиять на ход нормального хозяйственного оборота в аспекте логистического обслуживания является задачей эффективных менеджерских решений, ставит вопрос о необходимости определения, классификации и оценки логистических рисков.

*Ключевые слова:* логистические риски, оценка рисков, оценка убытков

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The theoretic-applied positions of forming of mechanisms of pricing and factors, influencing on acceptance of price decisions in a retail business are considered in the article. Classification of enterprises of retail business is resulted. Maintenance of concept is exposed formats of shops of point-of-sale network.

*Keywords:* logistic risks, risk assessment, loss estimation

Management of logistics processes involves exposure to the action of a number of uncertainties that are random. Operation of these factors may adversely affect the course of normal commercial trade in terms of logistics services and that is the task of effective managerial decisions, which raises the question of necessity of determining, classification and evaluation of logistics risks.

#### Analysis of recent research and publications

Analysis of recent research and publications show that this problem was studied by many researchers. The problem of logistics risks explored such scientists as A. Semenko, V. Syerhyeyev, A. Labuta, A.V. Tkachev, A. Sudakova, G. Hurin, V. Revenko, E. Yenchenko. However, logistics is relatively young science in Ukraine, logistical risks assessment is still largely unexplored so this problem is relevant for further study and research.

#### Unsolved aspects of the problem

Identification of risk and its value has a random nature and the quantitative evaluation can be obtained when using the theory of probability.

The purpose of the article is to classify some of the statistical and expert methods of logistic risk assessment.

#### The main material of the research

As in every functional area, in the logistics system there is a set of specific risks. Reducing their size depends on the solution of a number of pragmatic issues, such as, for example, a determination of the type of risks that may arise in the performance of logistics operations and in functioning of logistic system.

To build an effective risk management system we should mark the very subject of management – a risk. A risk should be understood as the probability of an unfavorable situation of failure or industrial, economic, financial, or other organization activity. It should be noted that among the main causes of risk it is not only the statistical possibility of an unfortunate situation, but also three other factors of external and internal logistics environment: uncertainty, randomness and countering [1].

The generally accepted definition of risk is the probability of an event that causes losses. In particular, the transport risk of default of the counterparty in the logistics system is regulated by international and national law, establishing the process of replacing such losses.

Risk is the probability of an event that involves occurrence of loss. Reliability is one of the principles of logistics.

There are following risks of logistic system:

1) Commercial risk. It is expressed as a disruption of supply, loss of production, violation of terms of delivery, failing financial obligations, loss of income by irrationality procurement, transportation, storage and more.

2) The risk of property loss due to poor environmental conditions, including natural disasters.

3) Risks appearing due to theft of inventory items, including hijacking vehicles.

4) The risk of civil liability which arises due to the damage caused to individuals or legal entities in the process of logistic activities.

5) Technical risks are associated with the operation of technical means in the logistics system.

Risks and associated property damage can largely be reduced by the work of the staff employed in the logistic process [2].

The main reasons of risk are three environmental factors that define the different situations or set of circumstances: the uncertainty, randomness and countering, which must be considered, anticipated, planned, and, if possible – reduced, mitigated and prevented.

Uncertainty is considered as the sum of circumstances that can be predicted in advance, but it is impossible to determine how much they affect the resulting performance of logistics activities. Randomness includes circumstances that may arise regardless of the overall situation in the majority of cases that occur under the influence of environmental factors.

Countering is an intentional resistance to the circumstances and participants logistics process of its implementation.

To reduce the significance of adverse events is usually a system of "risk management", which includes a number of following activities [3].

Definition of risk involves identification of sources of risk and the size of potential losses from the onset of unacceptable events. Let us consider the classification of transportation risks:

1) Commercial risk. It is expressed as a disruption of supply, loss of production, violation of terms of delivery, failing financial obligations, loss of income by irrationality procurement, transportation, storage and more.

2) Risks affecting the cargo from without: accidents, climate, government prohibitions, insolvency or bankruptcy of subcontractors, errors in registration procedures of payments, delay in transit, loss or damage during storage, storage and other operations in the warehouse and in preparation for transport, high cargo concentration and low skilled workers;

3) Risks affecting the external objects through the incidents of cargo: victims of accidents, damage to the property of the contractor, damage another's property and customs risks;

4) Other risks, the costs of rescue and accident; liquidation of consequences, costs of attorney and surveyor and other expenses [4].

Experts can identify risks before they occur. It is important to distinguish the effect on the value of risk factors. These risks include: the type of product and its packaging, means of transport (type of transport, the number of vehicles and their features), timing and duration of transportation and transport routes, etc [5].

Risk identification allows subsequently obtaining quantitative and qualitative risk assessment – evaluation the probability of hazards occurrence, forecasting the probable level of losses at cost or real terms. The obtained results allow developing the organizational and technical measures to prevent or minimize the risk of loss [6].

Many risks are associated with the properties of the product that is presented for logistics services. Such risks can be prevented or reduced at the planning stage of the contract. For this is sometimes useful to follow some rules:

1) The contract presents specification (or attached) and set financial liability for its breaching;

2) Terms of maintaining product quality are fixed in the contract (consistent system of standards and samples, the percentage of materials, certification of quality, safe supply of the goods);

3) Properly made packaging and labeling, for violations a fine is established [7].

The ability to manage risk is to reduce, prevent and compensate losses that are determined after identifying the nature of the risk and obtaining its quantitative and qualitative evaluations. In assessing of risks there are used some basic approaches and a variety of methods.

According to the theoretical approach, the risk is calculated:

1) The contract presents specification (or attached) and set financial liability for its breaching;

2) On the basis of statistics by examining loss and establishing how often a certain level of losses appears;

3) Expert analysis is based on assessments and information received from the experts [4].

Choosing methods of risk assessment is most often associated with the circumstances and the required accuracy of estimation of losses from non-performance of contracts, agreements and other transactions.

Expert group is recommended to enroll with independent experts, among whom there is no feedback.

The procedure of calculation of risk assessment by the theoretical approach.

Here are the statistical tools of logistic risks evaluation.

In the first case risks are estimated on the basis of logical reasoning, empirically by extrapolation of past situations and predicting their future.

For risk assessment such tools of correlation and regression analysis can be used. If historical data for the previous period can be obtained, then a risk assessment for the future it is recommended to use models of the dynamics of trend time series.

We assume that we are aware of the loss for the period, for example – for the year, with a few observations, for example – monthly losses. Extrapolation of time series is made by using the construction of trend dynamics models. Trend of the model is used in case of presence of trend data for the period history.

Tab. 1. Time series of losses for the prehistory period

Observation period	$t_1$	$t_2$	$t_3$	...	$t_n$
Volumes of losses	$y_1$	$y_2$	$y_3$	...	$y_n$

The equation of the trend is the dependence of  $Y$  losses from period  $t$ .

$$Y = f(t) \tag{1}$$

where:

$Y$  – amount of losses,

$t$  – time period.

As  $f(t)$  we choose one or a few reference features (trends). Trends are selected depending on the time series' losses schedule (Table 2).

Tab. 2. Trends and dynamics models

Model	Model name	Application of the model
$y = a_0 + a_1t$	linear first-degree	A linear model is used to describe processes characterized by evenly growth (with $a_1 > 0$ ) or an even decline (with $a_1 < 0$ )
$y = a_0 + a_1t + a_2t^2$	square (parabola)	Economic processes are described with some deceleration or acceleration, depending on the values of parameters
$y = a_0b^t$	exponential	Depending on the parameter $b$ Exponential function describing the various economic processes: rapid growth with $b > 1$ , slow decline for $0 < b < 1$
$y = a_0 + a_1/t$	linear hyperbolic	Depending on the values of parameters $a_0$ and $a_1$ hyperbolic function (sometimes called reverse) describes the economic processes of saturation and decline
$y = a_0 + a_1 \ln(t)$	linear logarithmic	The model occurs as characteristic of processes with slow growth or slow decline
$y = a_0 + a_1 e^t$	exponential	The model is used to describe the process of intensive growth. Such processes are sometimes called cascade and are observed are periods of economic recovery.

Generally to receive a model several supporting functions are elected. Among those models we choose the most accurate, reliable and adequate, and thereon we carry out forecasts.

Evaluation of the accuracy of the model has two parameters – a standard error estimates  $S_{yx}$  and the coefficient of determination  $R^2$ . The model is believed to be accurate when  $R^2 > 0,7$  and

$$\frac{S_{xy}}{|y_{max} - y_{min}|} < 0.3 \tag{2}$$

where:

$S_{xy}$  – standard error of the model,

$y_{max}$  – maximum value of loss on the prehistory period,

$y_{min}$  – minimum value of loss on the prehistory period.

Assessment of the reliability of the model is carried out on two criteria:

Reliability overall model is tested by the Fisher's F-test. By this criterion, the hypothesis is tested:

$$H_0: \beta_1 = \beta_2 = \dots = \beta_k = 0 \tag{3}$$

where:

$\beta_i$  – regression coefficient of the general population  $i = 1, \dots, k$ .

Reliability coefficients of the model is checked using the Student t-test. By this criterion, the hypothesis is tested:

$$H_0 \beta_i = 0, i = 1, \dots, k, \quad (4)$$

The adequacy of the model is verified on the balance. The residues' independence is characterized by their autocorrelation coefficient  $r$  (1).

For example, after the analysis of a time series losses we have received three projections (Figure 1). In statistics this situation called a "fan" of forecasts.

Choosing the most reliable forecast is done through a research data on the external and internal environment of the company. There are three options:

- 1) Minimum logistic loss is along a logarithmic trend;
- 2) Realistic prediction is a linear trend;
- 3) Pessimistic outlook and the maximum loss is by the exponential trend.

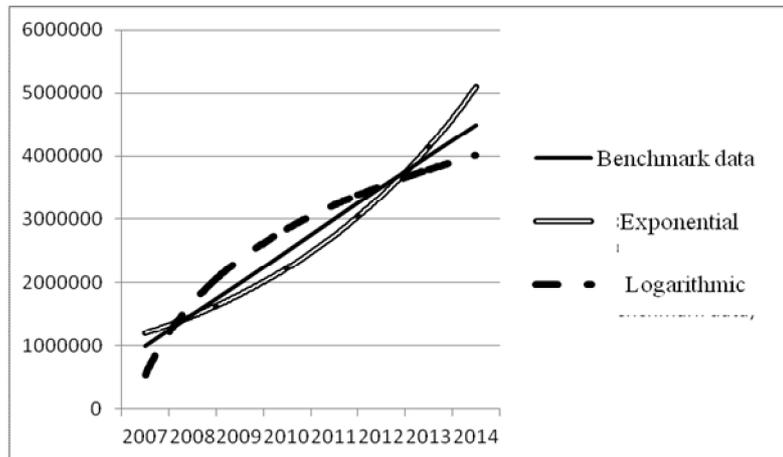


Fig. 1. Benchmark data and "fan" of forecasted losses

Source: The authors' own study

In the second case, the risks are assessed by examining the statistics of losses by establishing the frequency of certain level of losses occurrence.

Assume that the we know the logistic loss by the period of observation and the frequency of losses.

Tab. 3. Losses of the enterprise and their frequency

Volumes of losses	$y_1$	$y_2$	$y_3$	...	$y_n$
Frequency of observation	$n_1$	$n_2$	$n_3$	...	$n_k$

Estimated volume of losses in future periods may be calculated by the weighted average formula.

For an accurate estimation of the projected sales volume confidence interval is built.

$$\bar{Y} - \Delta \leq Y \leq \bar{Y} + \Delta \quad (5)$$

where:

$\Delta$  – limit of error calculated by the formula

$$\Delta = \frac{t\sigma}{\sqrt{n}} \quad (6)$$

where:  $N = \sum_{i=1}^k n_i$

$t$  – a parameter of the distribution function determined by the reliability of the confidence interval.

In the third case logistic risks are assessed on the basis of estimates and information received from the experts.

Statistical methods allow to determine the consistency of expert opinions, the significance of obtained estimates and so on. The degree of consistency indicates the quality of the resulting estimates.

$S$  is an expert assessment of loss of profit (increase of loss) due to the event of logistic risk.

Tab. 4. Expert assessment of logistic risks

Number of expert	1	2	...	$n$
Loss assessment	$S_1$	$S_2$	...	$S_n$

Average loss assessment that  $n$  experts provide is calculated as:

$$\bar{S} = \sum_{i=1}^n \frac{S_i}{n} \tag{7}$$

where:  $S_i$  – loss assessment given by  $i$  expert,  
 $n$  – number of experts.

The coefficient of variation in this case is:

$$\sigma = S^2 - (\bar{S})^2 \tag{8}$$

The degree of coherence of expert ratings is:

$$V = \frac{\sigma}{\bar{S}} * 100 \% \tag{9}$$

where:

$V$  – degree of coherence between expert evaluations expressed as a percentage.

The projected average loss assessment is given depending on the degree of coherence of expert opinions (Table 5). If the difference between the experts' estimates ranged within 10 percent, then the probability of risk  $P$  is 0.9 to 1. If the difference is more than 30%, then expert opinions are not consistent and the probability of risk can be estimated at the level 0.5 or lower.

Tab. 5. Expert assessments of probability of risk occurrence

V	P
[0;10]	[90-100]
(10;20]	[70-90)
(20;30]	[50-70)
(30;100]	[0-50)

Estimation results usually allow deciding on compensation arrangements, reducing or preventing the risk of logistics, which are based on current and constantly modified methods. Among them:

1) Diversification is the distribution of invested funds between different investment objects in the logistic system that are not directly linked thereby reducing risk and decreasing losses.

2) The transfer of risk (risk reduction) is done by transmitting side (Transfer) transferring the risk of the receiving side (transfers) based on the contract.

3) Limitation of risk by establishing maximum amounts of costs, sales, credit, etc.

4) Insurance is performed by transferring or allocation of risks arising from one entity among a number of entities.

5) Eliminating of risk is the refusal of certain activities associated with risk [4].

Minimization of risks arising in a logistic system is based on a number of organizational and economic measures purposefully and preventively reduce the likelihood of risks:

1) Availability of accurate, timely and complete formation.

2) Control actions in the logistics system that reduce the likelihood of risks and their negative effects.

3) The use of legal enactments for the right response to the occurrence of risk situations.

4) Having a developed logistic infrastructure and transport information.

5) Insurance processes of transportation, warehousing and cargo handling.

6) Prevention of further losses from risks [10].

**Conclusion**

Decisions on specific actions to avoid and reduce risk should be detailed in the deep study and analysis of risk situations that are possible in the future and in present.

In assessing logistics risks a number of statistical methods is offered, including:

1) Trend analysis using models of the dynamics of the time series;

2) Through studying statistics of losses to the establishment of certain levels of frequency of losses;

3) Based on estimates and information received from the experts;

4) Defining coordination expert assessments of future risks using the coefficient of variation.

The use of combinations of these methods in management practices will simplify the decision-making system of enterprises' logistics service.

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