

Risk Management in Logistics Chains

Andrey Butrin¹, Vladimir Vikulov²

1. Economics and Finance Department, National Research South Ural State University, RUSSIA, Chelyabinsk, Lenina avenue, 76 E-mail:butrin_ag@mail.ru

2. Economics and Finance Department, National Research South Ural State University, RUSSIA, Chelyabinsk, Lenina avenue, 76 E-mail:vikulov-vl@yandex.ru

Article is devoted to risk management of supply chain. The authors considered indicators of supply chain risks, including risks caused by supplier. Authors formed a method of optimizing the level of supply chain risk in the integration with suppliers and customers.

Key words – risk management, logistics chains, mathematical expectation of loss, classification of risks.

I. Introduction

This article was prepared as part of the state task "Organizational and economic support of innovative business management," 2012-2014, delivered by Russian Ministry of Education.

In the context of economic globalization and increasing complexity of economic relations enterprises need methods and techniques to improve and sustain its position in the global market. Integration processes offer businesses new opportunities, but at the same time present new challenges for the management, including the key objectives of risk management.

In our view, integration is a process of creation and the involvement of individual parts into a whole, taking into account the ability of their devices to achieve new qualitative state and acquire new capabilities. These results of such a state can be achieved through the integration process. [1],[2]

II. Methodical approach of risk management in logistics chains

Butrin A. [1] in his work "Methodical bases chain costs management in integrated enterprise" notes that participation in the integration process provides participants with the following features:

- more access to different types of resources (material, financial, labor);
- the opportunity to operate on a broader integration space;
- to create efficiencies;
- to create privileged conditions for integrating subjects and protect them from the competition of other non-interest in the structure of grace;
- an agreed solution.

Modern integration processes were reflected in risk management. Today, in some industries risk management is carried out on the level of the whole company, and

begins to go beyond a single enterprise, taking the form of an integrated process, accompanying the transition of companies to the concept of supply chain management (SCM). In this regard, we note the emergence of scientific papers on supply chain risk management (SCRM). This concept covers all aspects of the activity and serves as a strategically tool of risk management in the integration process. [6], [7]

In recent years, many papers have been in the field published by Russian scientists. This work can be structured in the following areas: strategic risk management, risk management in integrated structures, risk management of certain areas of the company, development of risk management system at the enterprise.

Here are the main weaknesses of the current stage of risk management:

- lack of theoretical and methodological framework for identifying risks and losses of their intensification;
- there is no methodology of risk management in the context of growing integration in the industry;
- local management of interacting participants functional without including risk component. It does not permit to achieve the desired synergies and reduces efficiency;
- the pricing based on the classical approach, does not fully take into account the risk of losses in the logistics chain.

Accordingly, the actual tasks are:

- disclosure of type of risks and organizational and economic nature of the risks and characteristics of industrial enterprises in the context of integration with suppliers and customers,
- development of risk minimization method in industrial enterprises current assets management,
- development of economic and mathematical model for determining the minimum level of risk in logistic chain.

We consider developed method of risk management in current assets management of industrial enterprises in the context of integration. In contrast to existing methods, authors propose method, firstly, based on fixing the sources of risk at their location in the circulation of current assets, which eliminates duplication, second, this method considers various schemes of logistic chain taking into account the specifics of interaction with contractors, each of which has its influence on the occurrence and size of the risk, and thirdly, based on intersystem approach and aims to choose the optimal parameters of current assets with the risk component in quasi-integration.

We offer the following composition of the risks listed in Table 1, in order to fix the source of the risk at their location in the supply chain. It corresponds to the placement of the main sources of risk in the various links of the supply chain. [2]

This approach to risk classification allows to fix the places of risks appearing in specific links of supply chain and identify "weak links" of the supply chain that may occur in the future, in contrast to most existing approaches, where the "weak links" are already determined after the fact. Systematic picture of the potential "weak links" in the chain is a useful

management tool not only for the risks and risk situations management, but also for improving of the overall efficiency of management company.

We have to go through several steps in order to solve the optimization problem of finding of the optimal value of the delay (timing) flows.

In the first stage it is necessary to accumulate all the necessary statistical and operational information in order to determine the magnitude of the losses and the probability of their occurrence. In the second stage, we calculate and group losses in the supply chain that are possible when operating the focus of each of the types of risks identified in Table 1.

TABLE 1
THE COMPOSITION OF THE VARIOUS RISKS
IN THE OF LOGISTIC CHAIN LINKS

Group of risks	Composition of risks
Risks associated with supplier	Risk of "care" supplier
	Risk of penalties to the supplier for violations of contract
	Risk of violating the delivery schedule resources
	Risk of buying poor quality resources
	Risk of non-delivery / short delivery resources
	Risk of changes in resource prices
	Risk of leaving the consumer reasons associated with supplier
Risks of the "Procurement"	Risk of failure in transport
	Risk of damage or loss transported values
	Risk of leaving the consumer for reasons, that have arisen in «Procurement»
Risks of the "Warehousing, storage, internal transportation resources"	Risk of improper storage resources Risk of loss of resources for internal transport
Risks of the "Production"	Risk of rhythm disorders of manufacturing
	Risk of producing unwanted products (overproduction)
	Risk of downtime production capacity for technical reasons
	Risk of failure in IT-systems of production management
	Risk of downtime for other reasons
	Risk of increase the marriage finished products
	The risk of poor control quality of products
	Risk of environmental losses
Risks of the "Warehousing, storage, internal transportation products"	Risk of improper storage products
	Risk of loss of products for internal transport
Risks of the "Sales and Marketing"	Risk of changes in the planned volume of sales
	Risk of failure of networking sales
	Risks choosing the wrong promotion strategy
	Risk of reduce market prices for finished products
Risks of the "Transportation of finished products"	Risk of failure in transport
	Risk of damage or loss transported values
Risk of the «Finance»	Risk of loss due to the binding of the capital in the functional "Procurement"
	Risk of loss due to the binding of the capital in the form of stock
	Risk of loss due to the binding of capital in the form accounts receivable from buyers
Risks	Risk of bad debt

Group of risks	Composition of risks
associated with the buyer	Risk of "care" buyer
	Risk of losses (gains) of default by the buyer

In the third stage, we calculate the probability of loss, based on the availability of statistical information.

In the fourth stage, we calculate the intermediate indicators of the expectation of losses for each type of risk.

The fundamental equation (1) of calculation of these indicators, which is the sum of the product of the probability of loss is shown below.

$$R(N)=\sum N_i * P(N_i), \quad (1)$$

where $R(N)$ is mathematical expectation of loss of specific stage current assets circuit, N is group of risk type, N_i is loss value of specific type of risk, $P(N_i)$ is probability of loss of specific type of risk.

In the fifth stage, we calculate to the integral expectation of loss of focus company, which is calculated as the sum of pairwise products of the value of losses in each of the links in the supply chain for their probability. It is as follows:

$$\text{Integr.R} = R(S) + R(P) + R(SR) + R(PR) + R(FS) + R(M) + R(D) + R(F) + R(C), \quad (2)$$

where Integr.R - integral expectation of losses on all stages, (S) - expectation losses caused supplier, R(P) - the expectation stage loss "Supply", R(SR) - expectation loss in " Warehousing, storage and internal transport resources", R(PR) - the expectation of loss under "Production", R(FS) - the expectation of losses in the process of "Warehousing, storage and internal transportation of finished products", R(M) - the expectation of the loss of the "Sales. Sale. Marketing", R(D) - the expectation of losses on the stage of "The transportation of finished products", R(F) - the expectation of loss of the "Financing", R(C) - the expectation of losses caused by the buyer.

In the sixth stage, we define the values t_{del}^{supp} , t_{del}^{cons} that provide the minimum value of the integral of the expectation.

For example, consider the distribution of the integral of the expectation of losses in a manufacturing enterprise JSC «Clean Ural», which engaged in the production of detergents and is closely associated with its suppliers and customers. The selection of calculations results performed expectation losses on the basis of statistical and expert enterprise data presented in Table 2.

Thus, we see that the best solution to optimize the level of risk is the duration of the period of repayment of the debt is equal to -5 days, and the period of collection of receivables is 10 days. Under these conditions, the interaction in kvaziintegratsii supplier of material resources and the buyer of finished products manufacturer to reach lower values of the expectation of losses up to 40,517.04 rubles., Which will reduce the rate to 83.55% from the current. In this case, the data values can be effectively achieved in the short term, as the decision has been selected, subject to certain limits for this.

TABLE 2

THE SAMPLE VALUES IN THE SEARCH AREA IN THE SHORT TERM DECISIONS

Duration of the period of repayment of the debt, days	Duration of the period of collection of accounts receivable, days	The expectation of losses in the stages of the current assets circuit, rubles.									Integr.R, rubles.	K _{eff}
		S	P	SR	PR	FS	M	D	F	C		
-5	10	12760,24	2247,78	71,44	4348,31	105,78	15349,12	-998,76	6597,71	35,42	40517,04	0,842
-5	11	12784,00	2247,78	71,44	4348,31	105,78	15349,12	-998,76	6655,21	35,42	40598,30	0,841
-5	12	12807,76	2247,78	71,44	4348,31	105,78	15349,12	-998,76	6712,67	35,42	40679,52	0,839
-5	13	12831,52	2247,78	71,44	4348,31	105,78	15349,12	-998,76	6770,10	35,42	40760,71	0,837
-5	14	12855,28	2247,78	71,44	4348,31	105,78	15349,12	-998,76	6827,49	35,42	40841,87	0,836
-5	15	12879,04	2247,78	71,44	4348,31	105,78	15349,12	-998,76	6884,86	35,42	40922,99	0,834
-4	10	12736,48	2247,78	71,44	4348,31	105,78	15349,12	-998,76	34444,53	35,42	68340,11	0,499
-4	11	12760,24	2247,78	71,44	4348,31	105,78	15349,12	-998,76	36823,91	35,42	70743,24	0,483
-4	12	12784,00	2247,78	71,44	4348,31	105,78	15349,12	-998,76	39133,68	35,42	73076,77	0,467
-4	13	12807,76	2247,78	71,44	4348,31	105,78	15349,12	-998,76	41376,86	35,42	75343,71	0,453
-4	14	12831,52	2247,78	71,44	4348,31	105,78	15349,12	-998,76	43556,29	35,42	77546,90	0,440
-4	15	12855,28	2247,78	71,44	4348,31	105,78	15349,12	-998,76	45674,65	35,42	79689,02	0,428
-3	10	12712,72	2247,78	71,44	4348,31	105,78	15349,12	-998,76	177932,03	35,42	211803,84	0,161
-3	11	12736,48	2247,78	71,44	4348,31	105,78	15349,12	-998,76	179330,53	35,42	213226,10	0,160
-3	12	12760,24	2247,78	71,44	4348,31	105,78	15349,12	-998,76	180513,44	35,42	214432,77	0,159
-3	13	12784,00	2247,78	71,44	4348,31	105,78	15349,12	-998,76	181527,05	35,42	215470,15	0,158
-3	14	12807,76	2247,78	71,44	4348,31	105,78	15349,12	-998,76	182405,28	35,42	216372,13	0,158
-3	15	12831,52	2247,78	71,44	4348,31	105,78	15349,12	-998,76	183173,55	35,42	217164,16	0,157

Conclusion

In this paper the proposed method allows us to fix risk origin places in various links of the supply chain and to identify "weak links" of logistic chain that may occur in the future. Method is a useful tool for managing not only risks and risk situations, but also as a tool to improve the efficiency of current assets management by providing the ability to optimize the level of risk in the industrial enterprise current assets management.

References

- [1] Butrin A., Vikulov V., 2012, Application of queueing theory for order execution quality assessment in supply chain, Materials of VIII International theoretical and practical conference «Modern scientific achievements», Sophia, 50-53
- [2] Butrin A., Vikulov V., 2012, Application of queueing theory for order execution quality assessment in supply chain, Materials of international scientific conference «Development of logistics business and transport system supported by EU funds», Zagreb, «Fakultet prometnih znanosti», 40-42.
- [3] Robert B.Handfield, Kevin McComarck, 2008, Supply Chain Risk Management: Minimizing Disruptions in Global Sourcing, Auerbach Publications Taylor & Francis Group, USA
- [4] Sheresheva M. Forms of network interaction of companies, 2010, National Research University HSE, Moscow
- [5] Teresa Wu, Jennifer Blackhurst, 2009, Managing Supply Chain Risk and Vulnerability: Tools and Methods for Supply Chain Decision Makers, Springer-Verlag London Limited, London
- [6] Tsaplin,V., 2011, Creation of efficiency of industrial enterprise chain cost, Vestnik of South Ural State University, 28 (245), 177–182
- [7] Vikulov V., 2011, Risk management in logistic strategy of industrial enterprise as applied to JSC «Chisty Ural», Materials of International theoretical and practical conference «Economics and Business. Young view», Chelyabinsk, 91-94.