

Approach to the Risk Management Process in Logistics Companies

Tereza Bartošová^{a,*}, Pavel Taraba^b, Kamil Peterek^b

^aTomas Bata University in Zlín, Faculty of Management and Economics, Mostní 5139, 760 01 Zlín, Czech Republic,

^bTomas Bata University in Zlín, Faculty of Logistics and Crisis Management, Studentské nám. 1532, 686 01 Uherské Hradiště, Czech Republic
 tbartosova@utb.cz

Larger companies have experts or even entire departments of experts to analyse potential risks, while for smaller companies and small businesses, the risk management process is difficult to understand. The aim of the article is to find out what approach companies in the Czech Republic in the logistics sector have to the risk management process. The article defined four research questions related to the size of the company and the amount of expenditure on the risk management process, the number of people involved in the risk management process, whether the risk management process is implemented by company employees or external staff, and whether the size of the logistics company affects the quantity and choice of crisis management methods. It was found that the larger the size of the company, the higher the company's expenditure on crisis management. The number of employees involved in the risk management process also corresponds to this finding, however, the size of the company does not affect the number of externals involved in the risk management process. The second position was occupied by the scenario planning method and the What-If Analysis method can be described as the third.

1. Introduction

One of the first defining risks is Bernoulli, who in 1738 proposed to measure the risk of a geometric mean and minimize the risk of its width through a set of independent events (Bernoulli, 1954). Risk management in companies was introduced to mitigate and minimize risks. Gao (2013) indicated that formal risk management frameworks are designed for large enterprises and are too complicated for small and medium enterprises. A large number of foreign authors, ie Thun a Hoenig (2011); Johnson (2001); Blos, Watanabe, Quaddus a Wee, (2009); Diabat, Govindan a Panicker (2012) examine the risks of supply chain projects in various industries.

The risk management process has proven to be a problem with the presence of uncertainties that are made from unexpected changes. To overcome the uncertain conditions resulting from the rapid change in technology, market demand and especially consumer preferences, organizations must now consider risk management in the logistics sector, which must be done in front of competitors (Soni and Kodali, 2013).

Today, the business process is becoming more complex due to a large number of entities and stakeholders involved in the entire business process. This creates large risk events from various business activities. These events are leading to increased attention in risk management more than before. Due to the uncertain nature and impact of the system on the company's financial performance, the logistics sector now faces greater risk than before (Chaudhuri et al., 2016).

Belás (2015) further specifies several types of risks, such as production, economic, market, financial, credit, legislative, political, environmental, personnel, information risks and force majeure. Risks are associated with all areas of business and the area of logistics is no exception. The Czech Republic has a unique position in the Visegrad countries in terms of logistics. It has a unique geographical location, excellent transport infrastructure and large logistics companies are attracted mainly by relatively low wages and skilled employees.

The logistics project is an important part of modern logistics. According to Xin (2007) a Wang (2012) it deals with a specific logistics activity that has the main effect on the process of achieving the complete goal. In

practice, you can find many logistics projects and each logistics project is different. Projects differ in their own scope and implementation through different resources, such as physical, human, and financial resources, and these resources are always required to a different extent (Pisz, 2011).

It is important to focus more on logistics projects implemented by logistics companies because by understanding the characteristics of a logistics project, we can separate the logistics project from other projects. This separation from other projects is especially important for the correct identification of risks identified in these projects and the subsequent implementation of a correctly chosen method to eliminate the risk.

The following attributes described below are typical for any project implemented in the company:

- unique,
- temporary,
- multidisciplinary,
- organized efforts,
- directed to the implementation of specified outputs (IPMA, 2015).

The characteristics described above are not only typical of a logistics project but define any project. The following characteristics are typical for a logistics project, thanks to which the logistics project differs from other projects.

- the need to take into account logistical conflicts (cost trade-offs),
- the decision criterion during the analysis should be the use of the total logistics costs,
- the need for adaptive management,
- the need to develop a methodology for the implementation of the project,
- the need to determine the level of services offered to customers as a result of the project implementation and within the project itself,
- determine the role and place of the logistics project in the organizational structure of the company (Kasperek, 2006).

Different types of projects represent a practical dimension of the solutions that need to be made to increase the efficiency of material flows in companies and supply chains, and these projects can serve as examples of how to implement assumptions and guidelines for logistics. Businesses and supply chains are involved in the implementation of specific logistics projects that prevent or alleviate problems with the flow of costs (products or goods) and people (Pisz & Łapuńska, 2015). The logistics project is mainly related to the transport, loading and unloading of transport items, packaging and supplies, which is independent and must work closely with the overall logistics process (Guo & Chen, 2008). Today's logistics project managers work in a rapidly changing environment. Their competencies are one of the key critical factors for the success of a logistics project. According to Witkowski and Rodawski (2008) logistics projects are one-off commitments of limited duration and funding, and their implementation serves to improve the efficiency of product flows and accompanying information flows in enterprises, supply chains or spatial systems.

The implementation of a project, including a logistics project, requires an answer to the question of how to achieve project success and thus mitigate the risks arising from project implementation. In practice, this means defining the measures that need to be taken to achieve the project on time with a budget and maintain the required quality. Research by Pisz and Lapunka (2017) shows that most companies do not plan the process of their logistics projects properly. The vast majority of respondents state that they do not create the necessary calculations, which leads to non-compliance with deadlines and budget overruns, and confirm the low efficiency and effectiveness of logistics projects. Such projects include those related to transport, warehousing, deployment of production and storage facilities, development or modernization of linear elements of logistics infrastructure, inventory management or customer service. Logistics projects are therefore aimed at increasing the effectiveness of activities that have been undertaken to address a specific economic, social, environmental or legal problem (Żuryński, 2015).

2. Methodology

The survey was carried out in three stages, which took place from June 2020 to December 2020. The first stage, which was to analyse relevant information sources in the field of risk management, took place during June and July. For the purposes of this article, the Web of Science, Scopus, ProQuest, and Google Scholar databases were used, where definitions of the concept of risk management were searched by keywords like risk management, etc. The second stage, which was aimed at collecting data on logistics companies operating

in the Czech Republic, was conducted in the form of a questionnaire survey between July and September 2020. The questionnaire was created based on the results of the first stage and was distributed by e-mail. In the third phase of the research, four research questions (cases) were analysed. The statistical dependence of individual answers with respect to the size of the company was verified. Research questions were defined as:

1. Whether the size of the logistics company affects the amount of crisis management expenditure,
2. Whether the size of the logistics company affects the number of people involved in the risk management process,
3. Whether the size of the logistics company affects the number of externists involved in the risk management process,
4. Whether the size of the logistics company affects the quantity and choice of crisis management methods.

The occurrence of individual answers from the survey was evaluated according to the contingency tables. These tables were used to summarize the relationship between the variables. A chi-squared test can be conducted on these contingency tables to test whether or not a relationship exists between variables. The Cramer's coefficient was used to measure the strength of the relationship between variables which can vary from 0 to 1. Values close to 0 indicate a weak association and values close to 1 indicate a strong association between the variables. The Cramer's coefficient V is defined by the formula (1), where K represents the chi-square statistic, n determines the sample size and m is characterized by the minimum number of rows and columns in the contingency table.

$$V = \sqrt{\frac{K}{n(m-1)}} \quad (1)$$

Due to the page limitation of this paper, only the results of hypothesis testing are presented. However, the contingency tables used in a research could be easily created from presented Figures 1-3. Everything written here applies to the statistical processing of the first three research questions. The last research question is different in nature from the others. Pivot table was not used during statistical processing, but only a comparison of the relative frequencies of all three categories of company size. Here, not only the relative frequency was examined, but also the order of individual answers with respect to the size of the companies.

3. Results

The research was focused on the logistics companies do business in the Czech Republic. For our purposes the micro-enterprises with only the maximum number of 9 employees were included in the section of small enterprises. Three research questions were examined.

3.1 First research question

A null and an alternative hypothesis was established for the first research question:

H1₀: The size of the company does not affect the amount of crisis management expenditure.

H1_A: The size of the company affects the amount of crisis management expenditure.

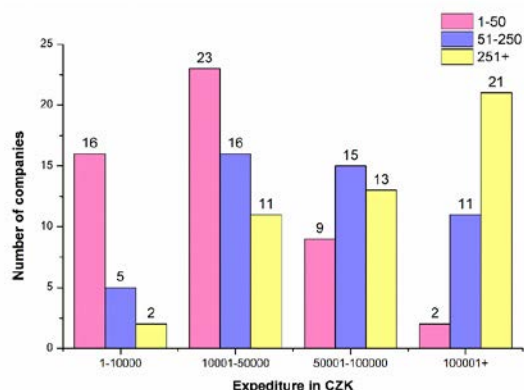


Figure 1: Amount of expenditure by companies on crisis management

During the analysis of the first research question these results of the monitored values were obtained: The chi-square statistic is 35.403. The critical value is 12.592 (6 degrees of freedom). The p-value is 0.00001. So, there is the significant difference between the observed and expected frequencies. The result is significant at

$p < 0.05$. The null hypothesis can be rejected and it can be concluded that the larger the size of the company is, the greater is the company's expenditure on crisis management. The Cramer's coefficient is 0.496 which means the mean dependence between variables. The distribution of individual responses in the graphical visualization is presented in Figure 1. The colour distribution of enterprises is as follows: pink - micro-enterprises and small enterprises, blue - medium enterprises, and yellow - large enterprises. The division of enterprises is according to the number of employees.

3.2 Second research question

A null and an alternative hypothesis was established for the second research question:
 H2₀: The size of the company does not affect the number of people involved in the risk management process.
 H2_A: The size of the company affects the number of people involved in the risk management process.

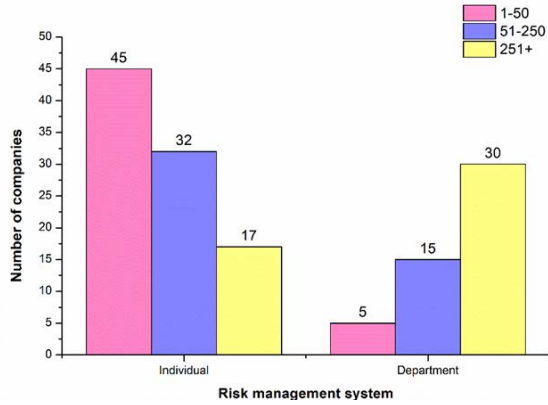


Figure 2: Number of people involved in the crisis management process in companies

During the analysis of the second research question these results of the monitored values were obtained: The chi-square statistic is 31.215. The critical value is 5.991 (2 degrees of freedom). The p-value is 0.00001. Thus, there is the significant difference between the observed and expected frequencies. The result is significant at $p < 0.05$. The null hypothesis can be rejected and it can be concluded that the larger the size of the company is, the greater is the number of people who are involved in the risk management process. The Cramer's coefficient is 0.466 that means weak dependence between variables. The distribution of individual responses in the graphical visualization is presented in Figure 2. The colour distribution of enterprises is as follows: pink - micro-enterprises and small enterprises, blue - medium enterprises, and yellow - large enterprises. The division of enterprises is according to the number of employees.

3.3 Third research question

A null and an alternative hypothesis was established for the third research question:
 H3₀: The size of the company does not affect the number of externists involved in the risk management process.
 H3_A: The size of the company affects the number of externists involved in the risk management process.

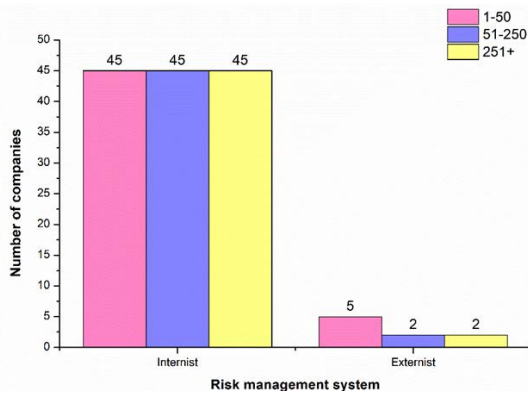


Figure 3: Number of externists involved in the crisis management process in companies

Dependence or independence can be decided directly from Figure 3. Nevertheless, the estimates were performed by analysis. During the analysis of the third research question these results of the monitored values were obtained: The chi-square statistic is 1.838. The critical value is 5.991 (2 degrees of freedom). The p-value is 0.398918. Therefore, there is not the significant difference between the observed and expected frequencies. The result is not significant at $p < 0.05$. The null hypothesis can be accepted and it can be concluded that the size of the company does not affect the number of externalists involved in the risk management process. There is no opportunity to calculate the Cramer's coefficient in this case. The distribution of individual responses in the graphical visualization is presented in Figure 3. The colour distribution of enterprises is as follows: pink - micro-enterprises and small enterprises, blue - medium enterprises, and yellow - large enterprises. The division of enterprises is according to the number of employees.

3.4 Fourth research question

The fourth research question was defined as: Whether the size of the logistics company affects the quantity and choice of crisis management methods. It dealt with a different dependence than the previous research questions. Again, the dependence concerned the size of the company, but the second variable was the qualitatively assigned methods of crisis management. The nature of the compared data did not allow the use of sophisticated data processing methods. During data processing, the relative frequency, size and order of use of individual methods were taken into account. Naturally all outputs were compared with the size of the companies. The whole analysis consists of a list of the most commonly used methods in crisis management. Respondents then select the ones they use most often in their companies. The results were compared not only in terms of the type of methods, but also in terms of the size of the company. In the questionnaire, the representatives of companies were asked about the most frequently used methods, which are: Failure Mode and Effects Analysis, Hazard and Operability Study, Event Tree Analysis, Fault Tree Analysis, PNH, What If Analysis, Scenario Planning and Checklist. There are three interesting conclusions in this area of the survey. The Checklist method was identified as the most frequently used method. A total of 45% of all respondents indicated this method in the survey. This method occupied the first place in all monitored size categories. In companies with up to 50 employees the share was 46%, in the category with up to 250 employees it was 43% and in companies with more than 250 employees it was even 47%. The second interesting output is also a comparison of the first three most frequently used methods. As mentioned above, 45% of company representatives ranked the Checklist method first, the second position was occupied by the Scenario Planning method (38%) and the What If Analysis method can be marked as the third with a share of 24%. It is interesting that the same order of methods also corresponds to the size categories determined by us. However, larger relative differences in the What If method, which occupied the third position, were noticed. Specifically, for companies with up to 50 employees, the shares were 46% (Checklist), 34% (Scenario Planning) and 16% (What If Analysis). In the second size category, the shares were 43%, 38% and 23%. In the category of over 250 employees it was 47%, 43% and 32%. The third output is the actual use of other methods in risk management of the companies. The Failure Mode and Effects Analysis, Hazard and Operability Study and Event Tree Analysis methods are used by about 9% of companies in the category of up to 50 employees, in the category of up to 250 employees the shares are around 11% and in the third size category there are shares over 21% (except for the Event Tree Analysis method, where the share is only 11%). From the mentioned above, it can be concluded that larger companies use more methods for their risk management. However, the selection of the three most used risk management methods is not influenced by the size of the companies. The previous conclusion also corresponds to the Fault Tree Analysis and PNH methods. Here, the share of respondents is already very low, across all size categories up to 5%. However, the PNH method was indicated in the questionnaire only by respondents of companies with more than 250 employees.

4. Conclusions

The article deals with the approach of logistics companies to the risk management process. Data were collected through a questionnaire survey, which was distributed via e-mail. A total of 144 companies doing business in the field of logistics took part in the research. Four issues were examined, namely: the amount of expenditure on the risk management process, the number of people involved in the risk management process, how many people involved in the risk management process are external and the last issue examined was the number and choice of risk management methods. All four problems were examined in relation to the size of the company (the size of the company was determined by the number of employees). The occurrence of individual responses from the survey was evaluated according to contingency tables. These tables were used to summarize the relationship between the variables. The data show that the larger the size of the company,

the higher the company's expenditure on the risk management process, and the more people are involved in this process to address it. However, this relationship does not apply to the problem with the number of externists, as the size of the company does not affect the number of externists involved in the risk management process. The Checklist method was identified as the most commonly used method. Larger companies use more methods to manage their risks. However, the choice of the three most used risk management methods is not influenced by the size of the companies.

Acknowledgments

This paper was supported by the Integral Grant Agency, Tomas Bata University in Zlín IGA/FAME/2019/006, and by support research program of Tomas Bata University in Zlín (RVO).

References

- Belás, J., Ključnikov, A., Vojtovič, S., & Sobeková-Májková, M., 2015, Approach of the SME entrepreneurs to financial risk management in relation to gender and level of education. *Economics and Sociology*, 8(4), 32–42. doi.org/10.14254/2071-789X.2015/8-4/2
- Bernoulli, D., 1954, Exposition of a New Theory on the Measurement of Risk. *Econometrica*, 22(1), 23. doi.org/10.2307/1909829
- Blos, M. F., Watanabe, K., Quaddus, M., & Wee, H. M., 2009, Supply chain risk management (SCRM): A case study on the automotive and electronic industries in Brazil. *Supply Chain Management: An International Journal*, 14(4), 247–252. doi.org/10.1108/13598540910970072
- Chaudhuri, A., Srivastava, S. K., Srivastava, R. K., & Parveen, Z., 2016, Risk propagation and its impact on performance in food processing supply chain: A fuzzy interpretive structural modeling based approach. *Journal of Modelling in Management*, 11(2), 660–693. doi.org/10.1108/JM2-08-2014-0065
- Diabat, A., Govindan, K., & Panicker, V. V., 2012, Supply chain risk management and its mitigation in a food industry. *International Journal of Production Research*, 50(11), 3039–3050. doi.org/10.1080/00207543.2011.588619
- Gao, S. S., Sung, M. C., & Zhang, J., 2013, Risk management capability building in SMEs: A social capital perspective. *International Small Business Journal*, 31(6), 677–700. doi.org/10.1177/0266242611431094
- Guo, X., & Chen, X., 2008, Project logistics development trend and countermeasures analysis. 3(22), 86–87.
- IPMA, 2015, Individual Competence Baseline. International Project Management Association (I. P. Management (ed.)).
- Johnson, M. E., 2001, *INDUSTRY*. 43(3).
- Kasperek, M., 2006, Planning and organization of logistic projects. House of University of Economics in Katowice.
- Pisz, I., 2011, Controlling of logistics project. *Total Logistics Management*, 107–125.
- Pisz, I., & Łapuńka, I., 2015, Zarządzanie projektami w logistyce. Difin S.A.
- Pisz, I., & Łapuńka, I., 2017, Logistics Project Planning under Conditions Of Risk and Uncertainty. *Research Journal of the University of Gdańsk Transport Economics and Logistics*, 68, 89–102. doi.org/http://dx.doi.org/10.5604/01.3001.0010.5325.
- Soni, G., & Kodali, R., 2013, A decision framework for assessment of risk associated with global supply chain. *Journal of Modelling in Management*, 8(1), 25–53. doi.org/10.1108/17465661311311969
- Thun, J. H., & Hoenig, D., 2011, An empirical analysis of supply chain risk management in the German automotive industry. *International Journal of Production Economics*, 131(1), 242–249. doi.org/10.1016/j.ijpe.2009.10.010
- Wang, X., 2012, Describes the particularity of project logistics and response. 139(3), 68–69.
- Witkowski, J., & Rodawski, B., 2008, Logistic Project - Definition, Typology and Risk. *Prace Naukowe Uniwersytetu Ekonomicznego We Wrocławiu*, 87–96.
- Xin, C., Cui, Y., & Zhao, J., 2007, Several problems in logistics engineering exploration study. 29(5), 206–208.
- Żuryński, R., 2015, Perspektywa zarządzania projektami logistycznymi w organizacji masowych imprez sportowych w sytuacjach kryzysowych. *Ekonomiczne, Społeczne i Środowiskowe Uwarunkowania Logistyki*, 200–214. doi.org/DOI: 10.15611/pn.2015.383.15