

## CLUSTER COOPERATION AND RISK LEVEL IN SMALL AND MEDIUM-SIZED ENTERPRISES

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**Abstract:** One of the most important stages in the process of risk management is the risk identification and classification, which are required in each entity located and operating in the environment that is: dynamic, influenced by various external and internal factors and exposed to some types of risks. The main research aim is to identify the most important categories of risk and to develop knowledge about risk management in cluster cooperation. The proposal of the methodology is based on the results of the survey conducted in small and medium sized enterprises in Slovakia in 2016 and the literature review. Risk categories will be analyzed and evaluated with the use of quantification method – non-parametric multi-selective Kruskal-Wallis test. The contribution of the paper consists in pointing out the types of risk the entities have to consider in the framework of cluster cooperation. The results of the paper show that the most important categories of risk are mainly market, political and technical risks.

**Key words:** risk management, cluster, cooperation, SMEs

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### Introduction

Current economic activity is characterized by the forces of globalization, technological progress, deregulation and democratization collectively creating extremely complex business environment for companies and their groups, including clusters (Vojtovic and Krajnakova, 2014; Kordos and Karbach, 2014; Dagiliene et al., 2014). The complex view of the reality is important in understanding the processes and activities of an organization (Sipa et al., 2015). Each entity, whether it is a business entity, individual, educational institution, local authority, cluster or regional stakeholder, is located and operating in the environment that is dynamic, constantly evolving and is influenced by various endogenous and exogenous factors, which is exposed to some risk. In the paper, the entity which the different risks factors have impact on is considered as the connection of regional stakeholders in the network cooperation in the form of cluster. The concept of a cluster is a well-known issue but, nevertheless, the involvement of regional players in this form of cooperation is limited. Among many different reasons for this situation, the lack of information about the benefits

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and risks arising from cluster cooperation is one of the most serious problems. There are many types of risks that will be encountered in cluster creation and cooperation. Some of them have a minimal impact and some of them are crucial. They can be taken into account when creating the principles and processes for effective risk management in the process of clustering. They will help stakeholders to make decisions to produce the best possible outcome from cluster cooperation. There are many scientific articles about risk management of business and SMEs, however, only very few researchers reported the risk management of cluster cooperation. The authors found and analyzed some rare works focused on the topic of risk management for the specific field of entity cooperation by Xia and Chen (2011), Szczepański and Światowiec-Szczepańska (2012) or Fazli et al. (2015). It is not easy to find specific studies about risk management in the case of cluster cooperation in the scientific studies.

The main research aim is to identify the most important categories of risk and to develop knowledge about risk management in cluster cooperation. The research is also aimed at making contribution to the scientific discussion on the roles, features and future prospects of Slovak clusters. As a consequence, the specific goal of this paper is to put forward the conceptual methodological proposal for risk identification and classification in clusters.

### Literature Review

The risk can be understood differently for different activities. Several definitions of risk can be found in professional domestic and foreign works. General risk can be defined as the potential occurrence of an unfavorable event (Tarnóczy et al., 2015). In many scientific works, the definition of risk refers to such common characteristics as: the risk of such occurrence, the risk as a consequence, the risk as a potential threat and the risk as a deviation from the planned target (Verbano and Venturini, 2013; Pypłacz, 2013). When comparing the possible interpretations of the definition of risk, they can be divided into two basic groups (Myšková and Doupalová, 2015):

- the first group of definitions focuses only on the negative side of risk, where risk is perceived as a threat,
- the other group of risk definitions focuses on defining risks in terms of potential opportunities.

According to Ivascu and Cioca (2014), due to the significant potential impact of risk factors on the results of the enterprise and the impossibility of their full control by the enterprise, the risk analysis is an important dimension of the firm strategic management. Strategic management involves the sequence of steps, which are referred to collectively as risk management: risk identification, risk analysis and assessment, determining intervention priority to limit risk and risk treatment.

Now, managing risk is becoming a fundamental concern and the ability to identify risks and adapt to the turbulent business environment becomes the critical success factors for enterprises (Arena et al., 2010).

Veber (2014) describes risk management as “*a coordinated and systematic way of working with the risks applied throughout the enterprise, i.e. at all levels of management, including all business processes and all kinds of risks with respect to their relationships.*” Real risk management contributes to the development of the enterprise (Ivascu and Cioca, 2014). Managerial discretion in identifying risks and responding to them led to different approaches in managing risk such as financial risk, management, insurance and political risk management. All of these approaches can be used but their adoption is limited to the particular area (Soltanizadeh et al., 2014).

Risk categories can differ depending on the project, but they can be generally divided into two main groups defined as (Kardes et al., 2013):

- exogenous risks (political, economic, industrial, currency, social environment)
  - endogenous risks (stakeholders, resources, operational, supply chain, etc.).
- Dagnino and Padula (2002) showed that business cooperation can take different forms and scope (see Table 1), but it is always the tool of achieving business advantages. While some studies emphasize the positive impact of co-opetition on market performance (Luo et al., 2007) others focus on increase in innovativeness (Quintana-Garcia and Benavides-Velasco, 2004).

**Table 1. Types of business co-opetition** (Dana et al., 2013)

		Number of firms	
		two	more than two
Number of activities	one	Simple dyadic co-opetition	Simple network co-opetition
	multiple	Complex dyadic co-opetition	Complex network co-opetition

Coopetitive relations could involve many partners over time and concern several activities, particularly in clusters. Nowadays, the EU uses many tools for encouraging and supporting entrepreneurs in the promotion of business entities, mostly SMEs, to let them organize themselves in different consortia named clusters and subsequently, under this form, to apply to European institutions for obtaining the necessary funds for their development and indirectly the regions where they are located. So, the increasing popularity of clusters is connected with the growing number of policies and initiatives supporting them, because of their economical role as drivers of competitiveness and innovation, economic growth and jobs (Păuna, 2015). Clusters can be the key factor of foreign capital location and foreign investment can play the leading role in cluster helping, to strengthen synergies in all aspects of its operation (Bojar, 2007; Cselényi et al., 2005).

For enterprises within cluster, the most important advantage is the opportunity to gain the external resources, unavailable by separate market activity. Clusters are determined by the interactions taking place between people and entities created and led by people. These are the people that decide how much they are open to others, whether they want to share their vision, knowledge and ideas. While the success of a single business is determined by its capabilities of protecting its intellectual property, its market knowledge and skills, the success of clusters is the result of

open knowledge flows, transactions in the area of complementary skills and sharing innovations (Nowakowska-Grunt et al., 2014; Meyer, 2016). Thus, there is a need to become more innovative in clusters, being always one step ahead of the followers (Palmen and Baron, 2008). Although cluster cooperation brings many opportunities for business entities, it is connected with risk as well. In cluster engineering, many risks arise, from planning to implementation (Wang La-yin and Luo Fu-zhou, 2011). There is a need for constant analysis of the influence of particular risk categories on enterprises involved in cluster.

Small and medium-sized enterprises (SMEs) are known to have contributed to country's economic growth and employment (Li Xue, 2011). They are considered as an important pillar and stabilization factor of the economy of the country and its regions (Hudáková et al., 2015). However, SMEs differ significantly from larger organizations in nearly every aspect of the activity. There are many types of their specificities: environmental, behavioral, decisional, technological, structural or strategic (Iacono and Nagano, 2009). A lot of studies found that SMEs grow faster than their larger counterparts (Fiala and Hedija, 2015). SMEs are the significant stakeholders for cluster cooperation as well (Balog, 2015). This category consists of 49% of all members in clusters. Other significant categories of cluster members are large enterprises (15%), universities and R&D organizations (in total 12%), self-governing regions as well as towns (in total 9%). The managers of clusters consider SMEs (40%) and large enterprises (23%) as the key factors, but also universities and R&D organizations (in total 13%). The importance of the membership mainly depends on the quality and the contribution to the cluster development. In this case, corporations and universities play significant roles.

### **Methodology of the Research**

The focus of this research is SMEs, which constitute the vast majority of enterprises in clusters in Slovakia. The qualitative data were collected in several ways, mainly through the surveys with entrepreneurs in the Slovak regions, then through the consultation with managers of clusters and experts from the area of clustering, and Slovak and foreign universities in order to help the development of the research framework and explain the empirical results of this research.

In 2016 the statistical survey of business risks of SMEs in Slovak regions was accomplished. The relevant population of this research is all the enterprises with 0 to 250 employees. This population consists of 81 SMEs. The entrepreneurs who participated in the survey have experience or knowledge of the functioning of cluster. For this reason the research sample is considered as experts.

The number of the respondents and their main characteristics are presented in Table 2. With reference to the five categories of industries under examination 18.52% of the respondents belong to the group of self-employed persons, 61.73% to limited partnerships and 19.75% to joint stock companies. In terms of the structure of SMEs and the number of employees the survey results were as follows: 23.46% belong to the category of microenterprises (0-9 employees), 30.86% to the

category of small enterprises (10-49 employees) and 45.68% to the category of medium-sized enterprises (50-249 employees). The data were collected via the survey through in depth personal interviews.

**Table 2. Main characteristics of the respondents**

Industry	Respondents		Legal form			Number of employees		
	No	%	Self-employment	Ltd.	Joint stock companies	0-9	10-49	50-249
Engineering	25	31	0	19	6	4	7	14
Electrical engineering	9	11	0	7	2	0	2	7
Food	21	26	8	9	4	6	7	8
Agriculture	2	2	0	1	1	0	1	1
Services	24	30	7	14	3	9	8	7
<b>Total</b>	<b>81</b>	<b>100</b>	<b>15</b>	<b>50</b>	<b>16</b>	<b>19</b>	<b>25</b>	<b>37</b>

All the questions related to the risk management are based on the risk categorizations that appear in the activities of SMEs. The respondents were asked to identify the categories of risks that could occur in the case of cluster cooperation and which are significant from their point of view. In order to meet the main aim stated, the authors used empirical research methods (questionnaire, interview), statistical methods (non-parametric multi-selective Kruskal-Wallis Test) and statistical software Statistica.

### Results of the Research

In the framework of the scientific research project: Grant Agency VEGA [No 1/0918/16]: *Risk management of SMEs in the context of clusters' involvement activities in the Slovak Republic*, the authors found out that there were established more than 50 clusters in the Slovak regions. Not all of them are active; some of them were established only for specific projects.

Slovak Innovation and Energy Agency uses classification, which divides the Slovak clusters into two groups: technological and tourism. Due to the results of the project named V4 cluster policies and their influence on the viability of cluster organizations (co-financed by the International Visegrad Fund), a new classification of the Slovak clusters was prepared. The active clusters were sorted into the following groups: Agro-food industries clusters (AFC), Creative and cultural industries clusters (CCIC), Information and communication technologies clusters (ICTC), Key enabling technologies and R&D-based clusters (KETC), Manufacturing, energy and construction clusters (MECC), Service industries clusters (SIC). Table 3 shows the list of active Slovak clusters in 8 official regions.

**Table 3. Clusters in the Slovak regions**

Region	Official name of cluster	Cluster typology
Bratislava	Danube Knowledge Cluster	(SIC)
	EMOCITY - Cluster for E-mobility and Smart City	(SIC)
	National Energetic Cluster NEK	(MECC)
	ABC - Academic Business Cluster	(SIC)
Banská Bystrica	1st Slovak Engineering Cluster	(MECC)
	Cluster HOREHRONIE - association of tourism	(SIC)
	Cluster of Border Castles	(CCIC)
Košice	Tourism association Balnea Cluster	(SIC)
	Cluster AT+R	(KETC)
	Technology Cluster for Earth Resource Utilization	(KETC)
	BITERAP	(SIC)
Nitra	Košice IT Valley	(ICTC)
	Cluster for Energy Storage of RE	(MECC)
	Slovak Plastic Cluster	(MECC)
	Cluster Topoľčany - association of tourism	(SIC)
Prešov	Bioeconomy Cluster	(ICTC)
	Energetic Cluster of region Prešov	(MECC)
	Cluster of Tourism Slanské Vrchy	(SIC)
Trenčín	Railway Transport Cluster	(SIC)
	SLOVAK IT CLUSTER	(ICTC)
Trnava	Cluster VÁH	(SIC)
	Automotive Cluster Slovakia	(MECC)
	Electrotechnical Cluster - West Slovakia	(MECC)
	Energetic Cluster - West Slovakia	(MECC)
	Cluster of Tourism - West Slovakia	(SIC)
	Cluster for Green and Innovative Technologies Support	(KETC)
Žilina	Smolenice Cluster	(SIC)
	Cluster LIPTOV - association of tourism	(SIC)
	Cluster Orava	(SIC)
	Cluster TURIEC - association of tourism	(SIC)
	Z@ict	(ICTC)

All the questions related to risk management are based on the risk categorizations that appear in the activities of SMEs. The respondents were asked to identify the categories of risks that could occur in the case of cluster cooperation and which are significant from their point of view.

Due to the activities of the Slovak clusters and activities of SMEs, the focus of research was oriented to 9 categories of risks (technical, production, market, financial, economic, innovation, information, political and medial risks). The subjective perception of the entrepreneurs for each of the risk categories is assigned to the level ranging 1-5 (where 1 corresponds to the lowest level of risk and 5 – the highest level of risk). The percentages from the respondents' answers within the stated categories of risk are presented in Table 4.

The authors analyzed the effect of the selected categories of risks concerning their concentration in six stated fields of the economic branch: electrical engineering, food industry, agriculture, energy and services.

**Table 4. Percentage statements of the respondents' answers**

Category of risk	1	2	3	4	5
Technical	2.47%	9.88%	25.93%	30.86%	30.86%
Production	6.17%	20.99%	46.91%	20.99%	4.94%
Market	2.47%	3.70%	14.81%	32.10%	46.91%
Financial	9.88%	25.93%	46.91%	14.81%	2.47%
Economic	3.70%	20.99%	30.86%	44.44%	3.70%
Innovation	16.05%	23.46%	32.10%	19.75%	8.64%
Information	19.75%	18.52%	33.33%	22.22%	6.17%
Political	2.47%	4.94%	12.35%	34.57%	45.68%
Medial	12.35%	33.33%	30.86%	23.46%	12.35%

To evaluate the results the authors proceed with the results of the works by: Betáková et al. (2015), Hudáková et al. (2015) and Bednář et al. (2013). The statistical characteristics ( $\mu$  - mean and  $\sigma^2$  - variance) of the selected risk categories are given in Table 5.

**Table 5. The statistical characteristics of the selected risks in the SME activities which could occur in the case of cluster cooperation**

Category of risk	$\mu$	$\sigma^2$
Technical	3.78	1.15
Production	2.98	0.87
Market	4.17	0.97
Financial	2.74	0.84
Economic	4.12	0.98
Innovation	2.81	1.40
Information	2.77	1.41
Political	4.16	0.99
Medial	3.65	0.95

Due to the small research sample (81 respondents), the non-parametric Kruskal-Wallis test was used. The grouping variable was the type of the economic branch. The authors tested the hypothesis  $H_0$ : *The difference in mean values at particular risk among the branches is not statistically significant.*

The calculated p-value of the analysis of intensity variance of risk in all categories is higher than 0.05 for all categories. The  $H_0$  is not rejected. The results of Kruskal-Wallis test are in Table 6.

The authors admit the 0.95 probability of reliability that among the individual responses of the respondents in the surveyed branches the difference in mean values is not statistically significant.

Despite the difficult situation in the absence of legislation, the clusters in the Slovak republic were established and carry out their activities. The basic key for increasing development and success of cluster's activities is the recognition of risks, which certainly influences the quality of organization management.

**Table 6. The analysis of the variance of risks categories by using Kruskal-Wallis Test**

Category of risk	Kruskal-Wallis Test
Technical	H ( 4, N= 81) =4.516199 p = 0.3406
Production	H ( 4, N= 81) =1.355547 p = 0.8519
Market	H ( 4, N= 81) =3.685933 p = 0.4502
Financial	H ( 4, N= 81) =4.224638 p = 0.3765
Economic	H ( 4, N= 81) =5.325744 p = 0.2555
Innovation	H ( 4, N= 81) =5.268578 p = 0.2608
Information	H ( 4, N= 81) =5.509734 p = 0.2389
Political	H ( 4, N= 81) =2.972497 p = 0.5624
Medial	H ( 4, N= 81) =5.287458 p = 0.2591

Presented result could help to managers of clusters better understand the risk perception of the cluster's members. The knowledge of risk level contributes to their managerial work in the meaning of explaining the nature and importance of the cluster cooperation. The main problem of SMEs is lack of information about the benefits and risks that are influenced from cluster cooperation. The explanation, on which risks is necessary to focus, will help the SMEs with their connection into cluster cooperation. This is why, the topic is undoubtedly important from the point of view of management sciences.

### Conclusions

The results of this study are consistent with the ones by Belás et al. (2015), Dumitrescu et al. (2015), Fazli, et al. (2015) and Korombel (2012), where mostly economic, financial, technical and political categories of risks are important for SMEs and have impact on business environment. Referring to the highest rates of risk, the results of the research show that the most important categories of risk are mainly market, political as well as technical risks. The results of the non-parametric analysis showed that risk categories depend on the level of risk reported by the entrepreneurs in given areas. The results of the survey and interviews with specialists, researchers and other interested persons showed that risk management for cluster cooperation is an important part of SMEs and it is important to focus the scientific research on the stages of risk management. All the individual stages of risk management imply further scientific research. From this perspective, the authors think it is worth considering conducting similar studies on a bigger population in the future to identify regularities and dependencies and present recommendations to small and medium-sized enterprises in cluster cooperation. Finally, the indication of the research constraints is needed. The major constraint of the present research is a rather small research group, so the challenge for the future is to create and conduct more extensive research in the area of risk management in entities involved in cluster cooperation. In connection with this, another problem is a small amount of SMEs engaged in cluster cooperation in Slovakia and lack of unified legal regulations for the cluster concept.



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## WSPÓŁPRACA KLASTROWA A POZIOM RYZYKA W MAŁYCH I ŚREDNICH PRZEDSIĘBIORSTWACH

**Streszczenie:** Jedną z najważniejszych faz w procesie zarządzania ryzykiem jest identyfikacja i klasyfikacja ryzyka, pożądane w przypadku każdego podmiotu działającego w otoczeniu dynamicznym, determinowanym przez szereg wewnętrznych i zewnętrznych czynników i wystawionym na różnorodne rodzaje ryzyka. Głównym celem badawczym artykułu jest identyfikacja najważniejszych kategorii ryzyka oraz poszerzenie wiedzy o zarządzaniu ryzykiem przy współpracy klastrowej. Propozycja metodologii badawczej opiera się na rezultatach ankiety zrealizowanej w 2016 r. wśród małych i średnich przedsiębiorstw na Słowacji oraz na przeglądzie literatury przedmiotu. Kategorie ryzyka były analizowane i oceniane przy użyciu nieparametrycznego, rangowego testu Kruskala-Wallisa. Nowością w tym artykule jest przedstawienie typów ryzyka, z którymi przedsiębiorstwa muszą się mierzyć przy współpracy klastrowej. Wyniki badań pokazują, że najważniejszymi typami ryzyka są tu ryzyko produkcyjne, ekonomiczne oraz polityczne.

**Słowa kluczowe:** zarządzanie ryzykiem, klastry, współpraca, MSP

### 集群企業中的合作和風險級別

**摘要：**風險管理過程中最重要的階段之一是風險識別和分類，這是在環境中的每個實體所需要的：動態的，受各種外部和內部因素的影響，並暴露於某些類型的風險。主要研究目標是確定最重要的風險類別，並發展集群合作中風險管理的知識。該方法的建議是基於斯洛伐克2016年中小型企業調查的結果和文獻審查。將使用定量方法-非參數多選擇性KruskalWallis檢驗來分析和評估風險類別。該文件的貢獻在於指出實體在集群合作框架內必須考慮的風險類型。本文的結果表明，最重要的風險類別主要是市場，政治和技術風險。

**關鍵詞：**風險管理，集群，合作，中小企業