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Research article

The SMEs' perception of financial risks in the context of cluster cooperation

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Abstract: Although, the Small and Medium-sized enterprises are the most numerous members in clusters, many of their representatives do not know benefits from this type of cooperation and they perceive it as a risky in general. Whereby, the clusters present one form of sustainable development of SMEs business. The focus of this paper is to provide an analytical framework in which the SMEs' perception of selected risk indicators is investigated by characterizing the financial risks related to cluster cooperation. While risk indicators are presented through five main categories of financial risks. To gain the main aim of this paper following research methods were used: Chi square test to compare statistical significant differences between the stated groups of respondents, Z-score to investigate the statistically significant differences in individual responses, Pareto analysis to determine the most important risk indicators and Key risk matrix to assess the level of risk indicators. The results have showed, that most important risk indicators are from category of business risks and they related with main issues of cluster cooperation: human factor failure, legal risk and risk related to lose of own reputation. These results highlighted the importance of financial risks that may be necessary for SMEs, other stakeholders and policy makers to overcome the barriers in development of cluster cooperation. The added value of this paper is the comparison of SMEs' perception of risk indicators from several points of view and final evaluation is connected and compared with the perception of those SMEs that have or had experience with cluster cooperation.

Keywords: small and medium enterprises; cluster; cluster cooperation; financial risks; risk indicator

JEL Codes: L14, L25, L26, P13, G32

Abbreviations: SMEs: small and medium-sized enterprises; TO: tourism; TE: technological; CO: cluster-consideration; CE: cluster experience; RI: risk indicator/s; MicroE: micro enterprises; SME: small and medium enterprises, R11 Credit guarantee risk, R21 Commodity risk, R22 Currency risk, R31 Funding risk, R32 Market liquidity risk, R41 Human factor failure, R42 Information system of cluster, R51 Legal risk, R52 Reputation risk, R53 Taxation risk, R54 Credit rating risk

1. Introduction

Small and Medium-sized enterprises (SMEs) are the pillar of all modern economies due to their multifaceted contributions. According to Pavelková et al. (2009) and Ključnikov et al. (2019) these enterprises are of great importance for the world economy, despite limited marketing opportunities of SMEs (Rojík et al., 2016), because they support the competitive dynamics of economic systems and, directly or indirectly have influence on large enterprises, especially in terms of increasing efficiency, sustainable and innovation development. In addition, their significance relating to the export promotion strategies and their flexibility to adapt to new conditions within the economic cycles in international economics development is undeniable (Taušer et al., 2015). Mura and Kljucnikov (2018) argue that SMEs contribute to a solution of economic, social and political issues of the state. As Fojtikova and Stanickova (2017) state, the European Commission declares the source of the European economic strength is 23 million European SMEs representing thus 98% of the business sector. They cover two thirds of the employment contracts in the private sector and they have created about 80% of new job places in the last 5 years.

SMEs become also important stakeholders of clusters. The clustering creates new strategies and brings various economic and non-economic benefits through the sharing approach. Clusters are generally perceived as large conglomerations of business organizations, governmental bodies, academic and educational institutions. Competitive companies inside a cluster contribute to the growing competitiveness of economic sectors, regional and national economies (Navickas and Malakauskaite, 2009). The benefits lie on easier access to suppliers, distributors, markets, resources and support systems, achieving greater economies of scale based on a wide range of stakeholders, and increasing capacity in resources and skills. Cluster cooperation and a new productive environment like clusters undoubtedly highlight the role of risk management. If the entities in the cluster work in the same physical space, many activities are no longer under their own control and their activity is affected by a number of other risks that are not only related to their own activity but also to the activity of the whole cluster. The rules changing and solving the common projects within one group, will thus affect all areas of risk management, even in the case of clusters. In this context, the activity of SMEs in clusters is also endangered by many risks. It is vital for entrepreneurs to evaluate continually all the possible risks and to pay the same level of attention to decisions in this field as they pay to decisions in any other field (Abrhám, 2017).

The concept of risk management is elaborated mainly for area of business activity, project management, or the management of territorial development. The risk management for SMEs is elaborated partially and it is absent in case of cluster cooperation. In clusters, the concept of risk management needs to be applied in order to increase the interest in cluster cooperation, reduce the

uncertainty of entities involved in the cluster, the development of a cluster organization and, last but not least, long-term sustainable development.

Generally speaking, risk is understood as a risk of damage, loss or destruction, unlike uncertainty, when we are able to assign the likelihood of their occurrence in the future (Mynarzova and Stverkova, 2015). Risks are an essential part of any human activity. The requirement for explicit risk formulation related to the specific proposal of measures to minimize identified risks or the written expression to identified risks and their impacts on society and the customer segment (Klučka, 2017, Gorzeń-Mitka and Okręglicka, 2015).

There are several aspects of risk classification in the scientific literature: time aspect (strategic, operational), environmental aspect (external, internal), further breakdowns (financial, business, business, manufacturing, technological, exchange rate, political, social). For clustering it is necessary to focus in the first step especially on identification of risks in relation to the type and focus of the cluster, especially in terms of environment and risk division into: financial, business, risks of relations and links, operational, risks strategies and their implementation, risks in the area of innovation management, risks associated with projects being implemented in clusters and other types of risks associated with problematic areas specific to each cluster. We can say that in clusters, there are a set of specific risks that reflect the heterogeneous agenda of these organizations, from business to marketing to potential safety at work.

This paper is focused on financial risk. Hudakova et al. (2018) pointed out the fact, that only a few SMEs in Slovakia pay sufficient attention to financial risk. They do not create sufficient assumptions or preventive measures for assessing the risks, which would prevent the financial problems or the financial crisis of the company. Based on this niche the issue of crisis management in terms of financial risks prevention within SMEs needs to be highlighted and assessed. To solve this disadvantage appears to be the main task of this paper stated as a comparison of SMEs' perception of risk indicators being connected and compared with SMEs having an experience with being involved in cluster cooperation. There are financial risks on financial markets, which are generally understood as a potential financial loss for an entity (Drabik and Zamecnik, 2016). Financial risk management has received increased attention over the past years because of financial risks, though they are not a core competency of non-financial firms, they also influence their business operations, financial performance and the future of the company to a large extend (Belás et al, 2016; Okręglicka et al., 2015). Although the financial risks are not the core competency of SMEs, they can also have impact on their business operations. We can observe them in different forms. On one hand there are external financial risks depending on changes on financial markets. On the other hand there are internal financial risks, where the company itself is the source of the risk (Bhunia and Mukhuti, 2012). According to Jílek (2009), there are five main categories (types) of financial risks: (1) credit risk, (2) market risk, (3) liquidity risk, (4) operational risk and (5) business risk. In literature, each category is described by other risks (Cejkova and Fabus, 2015; Chen et al., 2010; Jílek, 2009; Verbano and Venturini, 2013; Ziegler et al., 2006). In this research, we signed them as the risk indicators (RI) and we choose those that are related to cluster cooperation (Table 2).

Within the project grant VEGA from Slovak Ministry of Education dealing with the issue of advantages and disadvantages for SMRs being involved in cluster cooperation the next step was to assess this cooperation within the financial risk management approach. This research outcome is to be beneficial for SMEs being involved in cluster cooperation to avoid negative financial traps and difficulties beforehand and to be aware of financial risks.

We focused on financial risks that are perceived by SMEs in case of their engagement into cluster cooperation. The main aim of this paper was to define and quantify the most significant RI related to financial risks that are important for SMEs in case of engagement into cluster cooperation. For the main aim achieving, the questionnaire survey was realized in frame, which the SMEs that have/had direct experience with cluster cooperation were interviewed. Due to the limitation of this research sample, second category of SMEs were interviewed, those that consider the engagement into cluster cooperation. The research was elaborated detailed through diversification of respondents according economic branch in which Slovak clusters operate, experience with cluster cooperation and size category of SMEs. The main aim was achieved. Our research showed that the most important financial risks are characterized by business risks and confirmed the impact of economic branch in the differences of the stated risk indicators perception.

The rest of the paper is organized as follows. A literature review about the risks definition and their breakdown is provided at the beginning of the paper, followed by descriptions of the methodologies and analytical part. Then, analyses from several points of views, results comparison are discussed in next section and conclusions placed at the end finalizing.

2. Literature review

The financial risks belong to the most serious ones in every company and represent the most serious problems resulting in terminations of the Slovak SMEs and they are especially the payment discipline and profitability. Even though the financial risks are not the core competency of SMEs, they can also have impact on their business operations. There are financial risks in financial markets, which are generally defined as the potential financial loss of an entity or corporation. This means that it is not an already realized or unrealized financial loss, but a loss in the future. This is primarily a loss resulting from a particular financial or commodity instrument or a financial or commodity portfolio. Existing loss is also referred to as expected loss and potential loss as unexpected loss. Any financial loss reduces the value of capital (Abrhám and Lžičař, 2018). According to Krajnakova et al. (2015) we can observe them in different forms. On one hand there are external financial risks depending on changes on financial markets. On the other hand, there are internal financial risks, where the company by itself is the source of the risk (Bhunia and Mukhuti, 2012). According to J Íek (2009), there are *five main types of financial risks*: (1) credit risk, (2) market risk, (3) liquidity risk, (4) operational risk and (5) business risk. Let's take a brief overview i.e. characterization and explanation of the five main types of financial risks having been mentioned above. Below each paragraph is to be dealing with the particular type of financial risk.

Credit risk is the risk of loss due to a debtor's non-payment of a loan or other line of credit (either the principal or interest (coupon) or both). Default occurs when a debtor has not fulfilled his or her legal obligations according to the debt contract, or has violated a loan covenant (condition) of the debt contract, which might occur with all debt obligations including bonds, mortgages, loans, and promissory notes (Jirankova and Hnat, 2012). Since financial innovation and derivatives grow rapidly in competitive financial industry, credit risk measurement and management become essentially important. Although SMEs are the most active economic units in national economy, the operational risk and credit guarantee risk are very high in SMEs due to their particular characteristics, which lead to a low credit rating in general (Chen et al., 2010).

Zak (2012) argues that *Market risk* means the risk of loss from changes in market prices as well as changes in the value of financial instruments or commodity instruments due to adverse changes in market conditions, i.e. unfavorable developments in interest rates, stock prices, commodity prices or the exchange rate. According to Sejkora and Sankot (2017) in a narrower sense, market risk reflects the size of the profits depending on the nature of market and results in frequent price volatility and, in extreme cases, a bankruptcy. Among the market risk authors such as Hanulakova and Dano (2018), Helisek (2016), Zemanova and Drulakova (2016) include the following risks such as Equity Risk—the risk that share prices will change; Commodity Risk—the likelihood that a commodity price, such as that of a metal or grain, would change; Currency Risk—the probability that foreign exchange rates would change; Interest Rate Risk: the risk that interest rates would go up or down as well as Inflation Risk—the risk that all the rises in prices of goods and services will undermine the value of money, and probably adversely impact the value of investments.

The degree of liquidity means the speed at which we are able to turn our investment back into cash. In the context of liquidity, transaction costs—the cost of exchanging assets for cash—should also be considered (Jirankova et al., 2015). According to authors such as Virglerová et al. (2016), Muller (2006), Lipkova et al. (2017) *Liquidity risk* arises from the variability of returns resulting from the way in which liquidity demand is met and can be divided into two categories: Funding risks regarding the ability to meet investment and financing requirements due to mismatches in cash flows. This is the risk of inability to secure cash on a portfolio of assets and liabilities with certain maturities and interest rates. The second one is the market liquidity risk resulting in a decline in the liquidity of instruments on market and the absence of a reasonable price the bank is afraid of the loss that may be achieved due to the low liquidity of financial markets i.e. commodity markets, foreign exchange markets, securities markets, credit and loan markets.

According to Ziegler et al. (2006), *Operational risk* is understood to be the risk of loss due to errors in operating systems or people working with them (e.g. human factor failure, including fraud). According to Verbano and Venturini (2013) operational risks are divided into three categories such as: trans bound risk—is the risk of loss that may occur in the execution of operations due to errors inherent in the execution of operations, errors due to the complexity of products and the inability of existing systems to execute them, errors in trade clearing or settlement. This is a risk relating to the processing, recording and settlement of transactions with banks; Operational management risk—is the risk that involves the execution of fraudulent operations related to the trading and processing of false accounting, counterfeiting and money laundering, unauthorized access to systems and models, dependence on a limited number of staff; at last there is the System risk—is the risk of loss from errors in support systems, such as errors in computer programs, errors in mathematical relationships of models, information systems, data transmission.

Business risk J ílek (2009) divides into seven categories: Legal risk—is the risk of loss from the legal requirements of partner or from the legal unenforceability of contract. The risk of a credit assessment change is a risk of losing the difficulty of raising funds at an acceptable cost; reputation risk—is the risk of loss from reputations on markets; taxation risk—is the risk of loss due to change in tax laws or unforeseen taxation; currency convertibility risk—is the risk of loss from the inability to convert the currency to another currency as a result of a change in political or economic situation; disaster risk—is the risk of loss from natural disasters, war, financial system crash, and so on; regulatory risk—the risk of loss due to inability to comply with regulatory measures and errors in

predicting future regulatory actions; and finally credit rating risk—the risk of loss resulting from the difficulty to obtain cash under satisfactory conditions.

In addition to the risks having been mentioned above some authors are adding also so called systemic risk as the risk of passing on certain difficulties when the failure of one institution to meet its obligations at maturity makes other institutions unable to meet their obligations at maturity. Such a failure can cause significant liquidity and credit problems and ultimately jeopardize the stability of financial markets. The systemic risk of the banking sector is increasing in case of higher interbank loans, deposits and joint ownership of banks (Belás et al., 2014; Belás et al., 2015). The failure of an institution may cause any kind of risk, which may subsequently endanger other companies in the same or a different market segment. In extreme case, the financial system as a whole may fail. The task of regulators and central banks is to be protected against this kind of risk (Taušer and Čajka, 2014). An ideal example of systemic risk was actions of the US Federal Reserve (FED) to rescue the largest insurance group AIG (American International Group). Its collapse would mean the systematic risk for the entire financial system through the settlement of CDS (Obadi and Korcek, 2016).

SMEs can see many barriers when getting on credit market. These barriers are increased if SMEs are innovatory. In this case, financial data are unreliable or even insufficient. That's why building a judgmental rating model is very important for financing SMEs' activities. The situation can get worse when SMEs ask credit from banks. There is usually a rule saying the smaller company the more important soft information. According to Helisek (2015) banks usually have different lending access that can be grouped into four categories: financial statement lending (based on the evaluation of information from balance sheet data), asset based lending (based on the provision of a collateral), credit scoring models (based on hard information), and relationship lending. To what extent a different treatment of retail credit and SMEs' loans is justified will depend on at least two factors: the ability of banks' internal risk rating systems to adequately capture the differences between different loans and different types of assets, and the methods used to calculate the relevant risk measure (Jiroudkova and Rovna, 2015).

3. Materials and method

The results of this paper are part of research project VEGA No 1/0918/16 Risk management of SMEs in the context of clusters' involvement activities in the Slovak Republic. Within the research project, the questionnaire survey focused on SMEs' perception of groups of risks, which have impact on SMEs' decision in case of their engagement into cluster cooperation was executed. The questionnaire survey was addressed to SMEs that potentially consider the engagement into cluster cooperation. Due this fact, there is a limitation in the research sample. The typology of Slovak clusters is specific. According to Slovak Innovation and Energy Agency, there are two types of clusters in Slovak regions: tourism (TO) and technological (TE). The technological clusters carry out activities in areas of: information and communication technologies, creative industry, bioeconomic focused on the fields of agriculture and food industry, engineering, power engineering, electrical engineering, building industry, automotive industry and scientific research. Toward this typology, the focus of the project and the sample selections were adapted. The sample selections of SMEs were also realized in accordance with the conditions defined in the literature (Borrego et al., 2009; Chráska, 2016). As Chráska (2016) stated, it is not possible to realize the survey within the whole population (parent population). Due to this fact, for the research, we reduce the parent population on

sample selection. The sample selection was realized based on the fact, that the properties of selected samples were as far as possible the same as for the whole group that we examine. The sample selection was realized not based in probability, but based on occasional choice. The survey was addressed towards to SMEs, which we can divide into following groups: SMEs that carry out their activities in the area of tourism and areas in which technological clusters operate and SMEs that have/had experience with cluster cooperation and SMEs that consider being engaged into cluster. The structure of research sample presents Table 1.

Table 1. The structure of respondents' sample.

Category of respondents		micro	small	medium	Total
Tourism SMEs	Cluster	271	206	39	516
	-consideration	(51.04%)	(38.79%)	(7.34%)	(97.18%)
	Cluster	7	8	0	15
	-experience	(1.32%)	(1.51%)	(0.00%)	(2.82%)
	Total	278 (52.35%)	214 (40.31%)	39 (7.34%)	**531**
Technological	Cluster	151	133	131	415
SMEs	-consideration	(31.01%)	(27.31%)	(6.90%)	(85.22%)
	Cluster	23	30	19	72
	-experience	(4.72%)	(6.16%)	(3.90%)	(14.87%)
	Total	174 (35.73%)	163 (33.47%)	150 (30.80%)	**487**

In total 531 respondents who participated in category of TO SMEs took part in the research. Of this number, 15 SMEs have experience in cluster cooperation. In terms of size category, the most enterprises (52.35%) attended the survey in category of micro enterprises (MicroE). In case of TE SMEs, the survey took part in total 487 SMEs. From the point of view of cluster experience, the 72 SMEs took part in the survey with this attribute. The structure of respondents according to size category in this type of SMEs was distributed more proportionally than in previous case (around 30% in each size category).

This paper is focused on SMEs' perception of group of financial risks that have impact on SMEs' decision about their engagement into cluster cooperation. Based on the literature review, we picked up five main categories of financial risks. Each category is described by several risk indicators. We selected and included into survey only those risks indicators that have connection with appearance in cluster cooperation (Table 2).

SMEs evaluated their perception of related risk indicators by using the six point Likert scale (from value 0—negligible consequence of risk, to value 5—the highest level of risk). For comparison and investigation of the statistical significant differences in SMEs' perception, we stated three hypotheses (A, B, C) and evaluate them by Chi-square test (Chi-sq. in text of tables) of independence and assessed at 5% of confidence level:

- *Hypothesis A: There are statistically significant differences in perceived intensity of risk indicators connected with the engagement into cluster cooperation between tourism and technological SMEs.*
- *Hypothesis B: There are statistically significant differences in perceived intensity of risk indicators connected with engagement into cluster cooperation between the SMEs with experience in cluster cooperation and those, in which this experience is missing.*

- *Hypothesis C: There are statistically significant differences in perceived intensity of risk indicators connected with engagement into cluster cooperation between micro enterprises and small and medium enterprises.*

Table 2. Categories of financial risks characterized by their risk indicators.

Category of financial risk	Indicator of financial risks for research
(1) Credit risk	R11 Credit guarantee risk
(2) Market risk	R21 Commodity risk
	R22 Currency risk
(3) Liquidity risk	R31 Funding risk
	R32 Market liquidity risk
(4) Operational risk	R41 Human factor failure
	R42 Information system of cluster
(5) Business risk	R51 Legal risk
	R52 Reputation risk
	R53 Taxation risk
	R54 Credit rating risk

Note: Source: own research based on works of Chen et al., 2010; J ílek, 2009; Verbano and Venturini, 2013; Ziegler et al., 2006.

Each hypothesis consists of the null hypothesis assuming there were no statistically significant differences between respondents' answers in division according economic branch, experience/consideration with cluster cooperation, size category of SMEs. The results were evaluated according to the result of p-value. If the calculated p-value is lower than 0.05, we reject the null hypothesis. To measure the power of dependence, the Cramer's V was used. Statistically significant differences in individual responses were evaluated by means of Z-score. The instruments of descriptive statistics and percentage of respondents' answers have been also used. The calculations were made through the statistical Software STATISTICA 6.0, Microsoft Excel and free available software SOCIAL SCIENCE STATISTICS.

After a general assessment of SMEs' perception of RIs, we used Pareto analysis. Through this method, we can determine which RIs are significant and which are less. We used the 80/20 rule, which works on the principle that 80% of the consequences are caused by 20% of the causes. The Pareto analysis was processed for three groups of respondents: economic branch, experience with cluster cooperation and size category (micro enterprises -MicroE and small and medium enterprises - SME). The part of this analysis is Pareto chart. For Pareto analyses, we used average values of respondents' answers to each RI. The graph depicts the Lorenz curve, which is intersected at 80% by the broken red line, which separates the significant RI from the less significant ones. The risk factors that are situated to the left of the vertical line are significant.

4. Results and discussion

In this section, the results of the statistical analyses are presented. General descriptive statistics, the results of Chi-square test and Z-score are presented in the initial section. The second section consists of the results of the Pareto analyses and last section consists of construction of Key risk indicators matrix.

4.1. The evaluation of SMEs' perception of financial risk categories

This initial section consists of the results of the questionnaire survey and statistical analysis. For each financial risk category, we present table with assessment of risk indicators that belong to the category. Each table consists of percentage of respondents' answers, descriptive statistics and statistical analysis of stated hypotheses (A, B, C).

The first category of financial risks presents the ***Credit risk***, which is historically considered as the oldest and the most significant of all financial risks. It lies in the uncertainty whether a client will meet its obligation, pay its debt on time and to full extent. Common activities in clusters could be also covered by credits and loans provided financial institutions. In our research this category is evaluated through one risk indicator R11 Credit guarantee risk (Table 3). Under this risk indicator, SMEs evaluated how risky they perceive the common repayment of common obligations, if they consider possible connection in cluster. The results of p value ($p = 0.00077$) of Chi-square test in case of *Hypothesis A* showed, that stated hypothesis is valid. On the significance level of 0.05 we confirmed that the perception of this risk indicator depends on the economic branch in which SMEs operate. The Cramer's V confirms small degree of dependence between these two qualitative signs. The statistical significant differences in individual responses of SMEs we can observe in case of value 1 ($p = 0.00068$) and value 5 ($p = 0.00262$). The result of p value ($p = 0.86215$) of Chi square test for *Hypothesis B* showed, that this hypothesis is not valid. We can't observe the statistical significant differences in the SMEs' perception of this risk indicator according experiences with cluster cooperation. The results of Z score also showed, that here are no statistical differences in individual responses. The results of Chi–square test for *Hypothesis C* also showed, that stated hypothesis is valid ($p = 0.00618$). But according Cramer's V, the statistical dependency between perception of micro enterprises and SME is small. There are statistical differences between individual responses only in case of value 0 ($p = 0.00132$). 17.55% of tourism, 17.95% of technological SMEs, 32.01% of SMEs that consider engagement into cluster cooperation, 3.49% of SMEs with cluster experience, 14.76% of micro enterprises and 20.74% of small and medium enterprises perceived this risk indicator as risky with high and the highest impact on their decision about engagement into cluster (value 4 + value5).

The second category of financial risks is the ***Market risk***, which is characterized by the risks that could occur because of adverse changes in market conditions. In our research, we consider as the main risk indicators for this risk category R21 Commodity risk (changes in material and energy prices) and R22 Currency risk. The common cooperation in cluster is also connected with these types of risk indicators depending on the cluster activities. The SMEs' perception of this risk indicators are shown in table 4.

Table 3. The assessment of Credit risk.

Hypothesis		A			B			C		
RI	Scale	Frequency (%)		Z score p value	Frequency (%)		Z score p value	Frequency (%)		Z score p value
		TO	TE		Consideration	Experience		MicroE	SME	
R11	0	5.18	3.49	0.18024	8.18	0.50	0.24604	5.28	3.39	**0.00132**
	1	6.28	2.69	**0.00068**	8.18	0.80	0.92034	4.79	4.19	0.08012
	2	10.27	9.37	0.83366	17.65	1.99	0.59612	8.67	10.97	0.89656
	3	13.66	13.56	0.28462	24.83	2.39	0.79486	11.07	16.15	0.12852
	4	12.56	10.57	0.63122	20.74	2.39	0.4777	10.07	13.06	0.71884
	5	4.99	7.38	**0.00262**	11.27	1.10	0.90448	4.69	7.68	0.11184
	μ	2.70	3.00		2.83	2.53		2.67	2.98	
	SD	1.44	1.40		1.44	1.44		1.49	1.36	
	Chi-sq.	21.10842			1.904848			16.24595		
	P value	**0.00077**			0.86215			**0.00618**		
	Cramer's V	**0.2**			0.0			**0.1**		

Note: Source: own research, μ—average value, SD—Standard deviation.

Table 4. The assessment of Market risk.

Hypothesis		A			B			C		
RI	Scale	Frequency (%)		Z score p value	Frequency (%)		Z score p value	Frequency (%)		Z score p value
		TO	TE		Consideration	Experience		MicroE	SME	
R21	0	6.58	2.79	**0.00044**	8.97	0.40	0.08364	4.29	5.08	0.81034
	1	4.99	3.99	0.60306	8.57	0.40	0.1031	3.99	4.99	0.98404
	2	7.28	6.68	0.841478	12.56	140	0.71138	6.18	7.78	0.9442
	3	11.07	10.87	0.4009	19.54	2.39	0.3125	1.17	11.76	0.54186
	4	12.56	13.36	0.09296	23.63	2.29	0.83366	10.07	15.85	**0.03078**
	5	10.47	9.37	0.95216	17.55	2.29	0.1936	9.87	9.97	0.101
	μ	2.93	3.19		3.02	3.38		3.06	3.05	
	SD	1.63	1.44		1.56	1.36		1.57	1.53	
	Chi-sq.	14.18081			7.446705			5.952492		
	P value	**0.01451**			0.18949			0.31088		
	Cramer's V	**0.1**			0.1			0.1		
R22	0	12.86	9.57	0.13362.	20.34	2.09	0.92828	11.07	11.37	0.1031
	1	11.76	8.37	0.08186	18.15	1.99	0.68916	9.57	10.57	0.34212
	2	8.67	10.77	**0.00932**	17.95	1.50	0.42372	8.37	11.07	0.63836
	3	10.37	9.37	0.89656	17.55	2.19	0.29372	8.67	11.07	0.84148
	4	5.38	5.48	0.45326	9.87	1.0	1.00000	4.19	6.68	0.18024
	5	3.89	3.49	0.9681	6.98	0.40	0.24200	2.69	4.69	0.14706
	μ	1.91	2.07		1.99	1.91		1.85	2.09	
	SD	1.57	1.52		1.55	1.49		1.52	1.56	
	Chi-sq.	10.11918			2.802163			6.5538		
	P value	0.07194			0.73045			0.2560090		
	Cramer's V	0.1			0.1			0.1		

Note: Source: own research, μ—average value, SD—Standard deviation.

In case of risk indicator R21 the *Hypothesis A* is valid. The results of p value (0.01451) in this case is lower than confidence level (0.05) It means, that perception of this risk indicator depends on the economic branch in which SMEs operate. However, this dependence according Cramer's V (p = 0.1) has only low degree. There are dependency in individual responses only in case of R21perception according economic branch for level 0 (p = 0.00044) and in case of perception according size category of enterprise for level 4 (p = 0.03078). This R21 was perceived as important indicator (value 4 + value 5) of risk by 23.03% of tourism SMEs and 22.73% of technological SMEs, 41.18% of SMEs that consider the engagement into cluster cooperation, only 4.58% of SMEs with experience with cluster cooperation and 19.94% of micro enterprises and 25.55% of small and medium sized enterprises.

In case of risk indicator R22, all working *Hypothesis A, B, C* were not valid. It means that perception of R22 by SMEs does not depend on their affiliation to stated groups (economic branch, experience/consideration with cluster cooperation, size category). If we compared individual responses, we can see differences only in one case of economic branch for value 2 (p = 0.00932). If we take into account the perception of this risk indicator by SMEs at the highest values (value 4 + value 5), we can see low percentage (from 1.4 to 16.85 %) in observed groups.

In the case of a cluster, the task of third category of financial risks—***Liquidity risk*** is to ensure that, even under less favorable conditions, the cluster has access to cash to meet the needs. In our research, we focused on two risk indicators R31 Funding risk and R32 Market liquidity risk. Their perception by SMEs and evaluation of stated hypotheses contains table 5.

When evaluating risk indicators R31 and R32, the *Hypothesis A* is valid only for R31 where, the p value was lower than 0.05 (p = 0.03117 in case of R31 and p = 0.00046 in case of R32). It means that only in this case the SMEs' perception depends on economic branch in which SMEs operate. Due to the results of Cramer's V (p = 0.1) this dependency has small degree. The rest of *Hypotheses (B. C)* were not valid. The dependency between individual responses was confirmed for indicator R31, Hypothesis A (value 1/p = 0.05118 and value 2/p = 0.0114) and R32, Hypothesis A (value 1/p = 0.03078 and value 4/p = 0.02852). Risk indicator was perceived as significant (value 4 + value 5) for respondents that consider the connection into cluster (35.8%). In addition, the risk indicator R32 is important mainly for this category of respondents (25.82%).

The fourth category of financial risk is the ***Operational risk. This risk*** is arising from faulty or inappropriate internal procedures, from human factor failure, from failure of used internal systems or from external events. In case of cluster cooperation, we focused on two risk indicators in this risk category: R41 Human factor failure and R42 Information system of cluster. Their perceptions evaluated by SMEs are stated in table 6.

Table 5. The assessment of Liquidity risk.

Hypothesis		A			B			C		
RI	Scale	Frequency (%)		Z score p value	Frequency (%)		Z score p value	Frequency (%)		Z score p value
		TO	TE		Consideration	Experience		MicroE	SME	
R31	0	4.09	2.69	0.20766	6.08	0.70	0.7414	3.39	3.39	0.35238
	1	3.39	4.59	**0.05118**	6.98	1.00	0.28462	3.29	4.69	0.53526
	2	7.58	9.57	**0.0114**	16.05	1.10	0.16452	7.28	9.87	0.53526
	3	15.85	12.66	0.28914	25.92	2.59	0.95216	12.66	15.85	0.95216
	4	10.87	8.77	0.45326	17.55	2.09	0.41794	8.47	11.17	0.65272
	5	11.17	8.77	0.33204	18.25	1.69	0.71138	9.47	10.47	0.35238
	μ	3.12	2.99		3.06	3.03		3.08	3.05	
	SD	1.46	1.43		1.44	1.49		1.48	1.42	
	Chi-sq.	12.27883			3.392186			2.343371		
	P value	**0.03117**			0.63976			0.79988		
	Cramer's V	**0.1**			0.1			0.0		
R32	0	8.08	3.69	0.09102	11.17	0.60	0.101	6.08	5.68	0.09692
	1	9.07	5.78	**0.03078**	13.76	1.10	0.41222	7.38	7.48	0.17384
	2	11.47	11.37	0.34722	20.14	2.69	0.11876	10.07	12.76	0.87288
	3	11.17	10.77	0.4965	19.94	1.99	0.96012	9.47	12.46	0.63836
	4	7.88	9.47	**0.02852**	15.45	1.89	0.37886	7.28	10.07	0.44726
	5	5.28	5.98	0.17068	10.37	0.90	0.63836	4.29	6.98	0.13888
	μ	2.33	2.73		2.50	2.67		2.39	2.63	
	SD	1.54	1.44		1.52	1.37		1.51	1.50	
	Chi-sq.	22.30408			5.660644			6.606251		
	P value	**0.00046**			0.34066			0.25162		
	Cramer's V	**0.2**			0.1			0.1		

Note: Source: own research, μ—average value, SD—Standard deviation.

The results of p value of Chi-square test in case of both risk indicators (R41: p = 0.0410; R42: p = 0.01103) showed, that only *Hypothesis A* is valid. Perceived intensity of risk indicators connected with engagement into cluster cooperation is dependent on economic branch to which SMEs belonged. This dependence has according to Cramer's V small degree (p = 0.1). The results of Chi-square test showed (p > 0.05), that *Hypothesis B* and *Hypothesis C* are not valid. The dependence between individual responses was present for indicator R41 in case of *Hypothesis A*, value 0 (p = 0.02202), value 2 (p = 0.0251) and value 3 (p = 0.00932). For evaluation of indicator R42, the dependency between individual responses was present for *Hypothesis A*, value 0 (p = 0.0151) and 4 (p = 0.00714) and for *Hypothesis C*, value 4 (p = 0.03752). From the point of view of overall importance evaluation, the risk indicator R41 was the most important (value 4 + value 5) mainly for SMEs that consider the engagement into cluster cooperation (53.44%). The risk indicator R42 is the most important also for this category of respondents (15.45%).

Table 6. The assessment of Operational risk.

Hypothesis		A			B			C		
RI	Scale	Frequency (%)		Z score p value	Frequency (%)		Z score p value	Frequency (%)		Z score p value
		TO	TE		Consideration	Experience		MicroE	SME	
R41	0	1.10	2.19	**0.02202**	2.99	0.30	0.98404	1.50	1.79	0.92034
	1	2.59	1.60	0.23404	3.79	0.40	0.93624	2.39	1.79	0.09296
	2	6.68	3.89	**0.0251**	9.47	1.10	0.65272	4.89	5.68	0.71884
	3	10.57	12.66	**0.00932**	21.4	2.09	0.92034	9.77	13.46	0.37886
	4	16.85	13.26	0.20766	27.22	2.89	0.75656	14.46	15.65	0.14986
	5	15.15	13.46	0.99202	26.22	2.39	0.57548	11.57	17.05	0.09492
	μ	3.60	3.56		3.59	3.53		3.51	1.85	
	SD	1.27	1.32		1.29	1.30		1.32	1.48	
	Chi-sq.	17.22392			0.4914797			6.861644		
	P value	**0.00410**			0.99243			0.23115		
	Cramer's V	**0.1**			0.02			0.1		
R42	0	11.86	7.68	**0.0151**	17.65	1.89	0.77948	9.67	9.87	0.12114
	1	12.26	9.07	0.13362	20.04	1.30	0.07672	9.97	1.37	0.47152
	2	9.97	8.97	0.92828	17.05	1.89	0.65994	8.87	10.07	0.48392
	3	11.47	11.57	0.27134	20.64	2.39	0.4654	9.67	13.36	0.36812
	4	4.39	6.38	**0.00714**	9.57	1.20	0.4593	3.79	6.98	**0.03752**
	5	2.99	3.39	0.31732	5.88	0.50	0.69654	2.59	3.79	0.50926
	μ	1.87	2.21		2.02	2.13		3.63	2.14	
	SD	1.47	1.50		1.49	1.50		1.28	1.50	
	Chi-sq.	14.85019			3.725028			7.596328		
	P value	**0.01103**			0.58965			0.17994		
	Cramer's V	**0.1**			0.1			0.1		

Note: Source: own research, μ—average value, SD—Standard deviation.

The last category of financial risk presents the ***Business risk,*** which is in general presented by seven risk indicators (legal risk, credit-raking risk, reputation risk, taxation risk and currency convertibility risk). For our research, we selected four risk indicators that could have impact on SMEs in case of their engagement into clusters: R51 legal risk, R52 reputation risk, R53 Taxation risk and R54 Credit rating risk. R51 is related with risk of loss from partners' legal requirements. R52 is related with risk of loss from reputations at market among own customers. The importance of reputation risk management and the quality of their assessment remain relevant as the probability of decrease in or loss of business reputation influences the financial results and the degree of customers', partners' and stakeholders' confidence (Kunitsyna et al., 2019). R53 is related with risk of loss due to changes in laws of taxations or unexpected taxation. Table 7 presents the result of research of SMEs' perception of these risk indicators.

Table 7. The assessment of Business risk.

Hypothesis		A			B			C		
RI	Scale	Frequency (%)		Z score p value	Frequency (%)		Z score p value	Frequency (%)		Z score p value
		TO	TE		Consideration	Experience		MicroE	SME	
R51	0	4.89	2.99	0.09102	7.38	0.50	0.36282	5.38	2.49	**0.00001**
	1	3.49	3.19	0.90448	5.88	0.80	0.41794	2.69	3.99	0.4654
	2	12.46	9.67	0.25428	19.44	2.69	0.08012	10.87	11.27	0.12356
	3	15.45	14.96	0.37346	27.92	2.49	0.4777	12.76	17.65	0.27572
	4	10.47	10.37	0.37886	19.24	1.60	0.39532	8.28	12.56	0.11184
	5	6.18	5.88	0.68916	10.97	1.10	0.97606	4.59	7.48	0.12114
	μ	2.79	2.94		2.87	2.78		2.66	3.01	
	SD	1.40	1.33		1.37	1.32		1.44	1.29	
	Chi-sq.	4.943128			4.691317			25.36354		
	P value	0.42287			0.45471			**0.00012**		
	Cramer's V	0.1			0.1			**0.2**		
R52	0	3.49	2.69	0.56868	5.88	0.30	0.22246	3.49	2.69	0.05238
	1	3.19	1.99	0.20054	4.99	0.20	0.17068	2.49	2.69	0.60306
	2	6.48	5.28	0.61708	10.07	1.69	**0.03572**	4.99	6.78	0.61006
	3	9.27	9.47	0.28914	16.95	1.79	0.83366	7.88	10.87	0.4354
	4	12.66	11.76	0.68916	22.43	1.99	0.5287	10.47	13.96	0.53526
	5	17.85	15.85	0.99202	30.51	3.19	0.8181	15.25	18.44	0.74896
	μ	3.47	3.56		3.50	3.59		3.46	3.55	
	SD	1.52	1.45		1.50	1.36		1.56	1.43	
	Chi-sq.	3.097278			7.420308			4.883980		
	P value	0.68499			0.19122			0.43021		
	Cramer's V	0.0555699			0.1			0.1		
R53	0	4.49	3.39	0.45326	7.28	0.60	0.61006	4.59	3.29	**0.01078**
	1	5.78	3.49	0.05614	8.57	0.70	0.56192	4.49	4.79	0.4354
	2	9.27	8.67	0.70394	16.45	1.50	0.6672	7.78	10.17	0.71138
	3	12.16	14.06	**0.01314**	23.53	2.69	0.47152	10.97	15.25	0.29834
	4	12.76	10.97	0.76418	21.24	2.49	0.41222	9.07	14.66	**0.02444**
	5	8.47	6.48	0.32218	13.76	1.20	0.5892	7.68	7.28	0.0703
	μ	2.91	2.96		2.93	3.02		2.86	2.99	
	SD	1.50	1.38		1.45	1.37		1.54	1.36	
	Chi-sq.	9.382329			1.822170			14.07028		
	P value	0.09476			0.87316			**0.01517**		
	Cramer's V	0.1			0.0			**0.1**		

Continued on next page

Hypothesis		A			B			C		
RI	Scale	Frequency (%)		Z score p value	Frequency (%)		Z score p value	Frequency (%)		Z score p value
		TO	TE		Consideration	Experience				
R54	0	10.27	5.88	**0.00308**	14.96	1.20	0.39532	8.18	7.98	0.09102
	1	7.68	3.59	**0.00058**	10.47	0.80	0.41222	6.48	4.79	**0.00328**
	2	9.37	9.07	0.52218	16.95	1.50	0.57548	8.28	10.17	0.92828
	3	12.56	13.16	0.12602	23.53	2.19	0.67448	10.77	14.96	0.3125
	4	8.87	9.27	0.22628	15.75	2.39	**0.03846**	7.08	11.07	0.09492
	5	4.19	6.08	**0.00906**	9.17	1.10	0.57548	3.79	6.48	0.09894
	μ	2.28	2.74		2.46	2.77		2.30	2.65	
	SD	1.57	1.51		1.56	1.55		1.56	1.54	
	Chi-sq.	27.23131			5.381669			15.57817		
	P value	**0.00005**			0.37110			**0.00816**		
	Cramer's V	**0.2**			0.1			**0.1**		

Note: Source: own research, μ—average value, SD—Standard deviation.

Within the assessment of stated risk indicators the Hypotheses were valid as follows:

- *Hypothesis A* (about dependency on economic branch to which SMEs belonged) —in case of indicator R54 (p = 0.00005), the dependence of SMEs' perception of this indicator according Cramer's V had small degree (p = 0.2).
- *Hypothesis C* (about dependency on size category to which SMEs belonged) – in case of indicators R51 (p = 0.00012), R53 (p = 0.01517) and R54 (p = 0.00816) with small degree of dependence (Cramer's V p = 0.2 and 0.1) in all cases.

For the rest of risk indicators, the stated *Hypotheses* were not valid. The dependences in individual responses evaluated by Z-score were confirmed in cases as is stated in table 7.

4.2. The Pareto analysis

In order to determine the important of risk factors, we subsequently created the Pareto charts from the average response values of respondents from three SME categories (economic branch—Figure 1 and 2 experience with cluster cooperation—Figure 3 and 4 and size category Figure 5 and 6).

Figure 1 and 2 depict the Pareto analysis for observed risk indicators of financial risks of SMEs that belonged to TO or TE enterprises. For TO SMEs the significant factors are R41, R52, R31, R21, R53, R51, R11, R32. For TE SME: R41, R52, R21, R11, R31, R53, R51, R54.

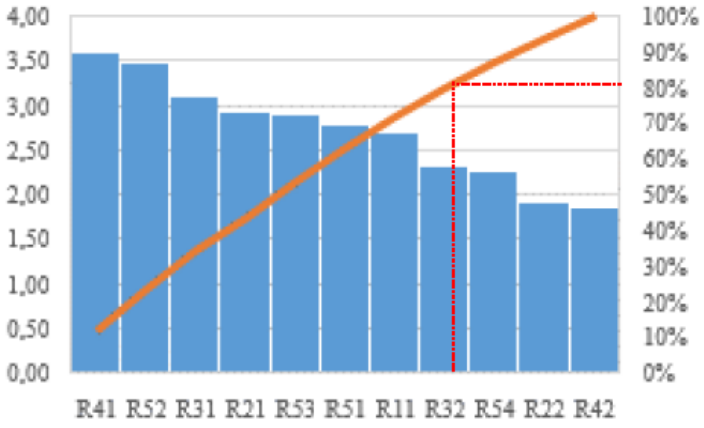

Figure 1. Pareto analysis for TO SMEs.

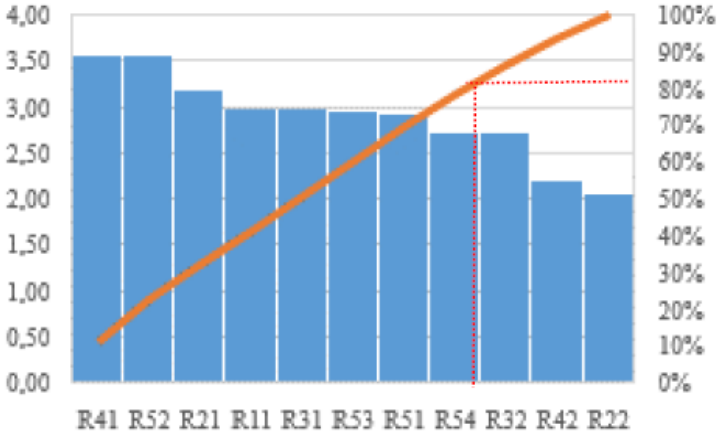

Figure 2. Pareto analysis for TE SMEs.

Figure 3 and 4 depict the Pareto analysis for SMEs depending on the experience with cluster cooperation. For SMEs that considering the engagement into cluster cooperation the important are risk indicators: R41, R52, R31, R21, R53, R51, R11, R32. For SMEs that have or had experience with cluster cooperation the important risk indicators are: R52, R41, R21, R31, R53, R51, R54 R32.

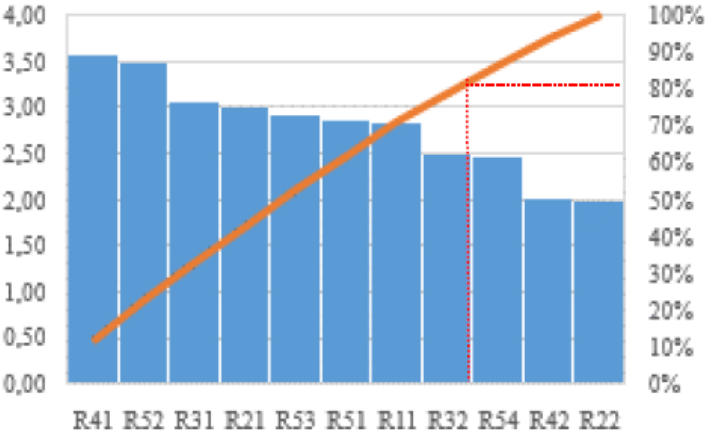

Figure 3. Pareto analysis for SMEs that consider the cluster cooperation.

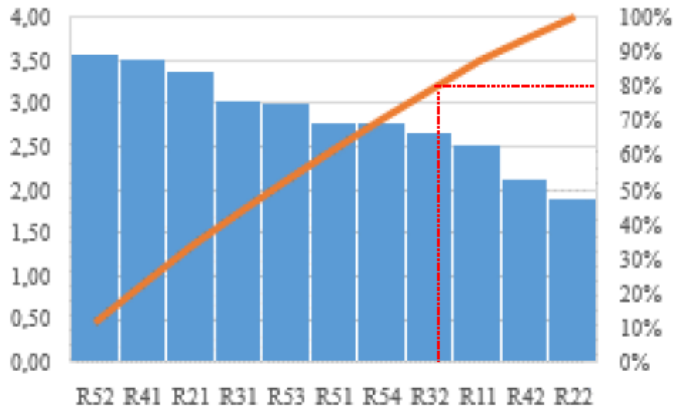

Figure 4. Pareto analysis for SMEs with experience with cluster cooperation.

Figure 5 and 6 depict the Pareto analysis for SMEs according to their size category. MicroE perceive as the most important risk indicators for them: R42, R41, R52, R31, R21, R53, R11, R51. For SME are the most important risk indicators: R52, R21, R31, R51, R53, R11, R54, R32.

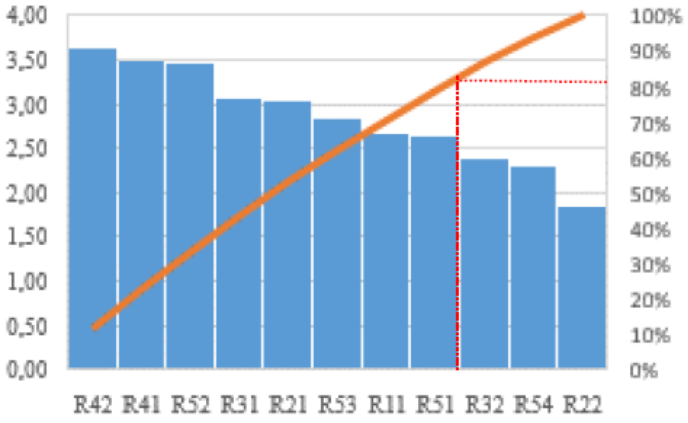

Figure 5. Pareto analysis for MEs.

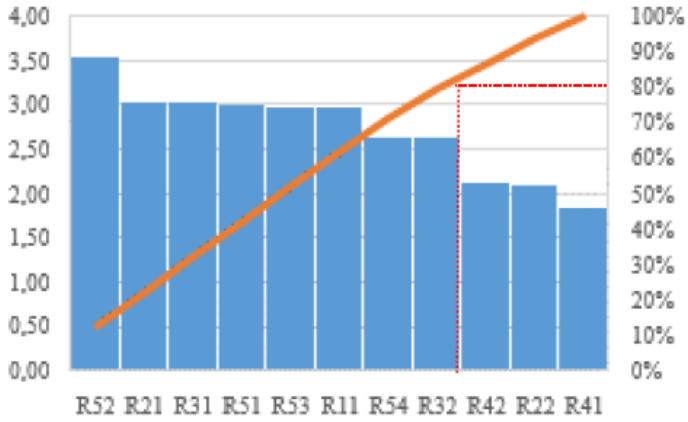

Figure 6. Pareto analysis for SMEs.

The results of individual Pareto analyses showed that for all SMEs, the most important risk indicators are: R21, R31, R51, R52 and R53.

4.3. The identification of crucial financial risks

In addition, for the identification of crucial financial risks through the risk indicators in connection with cluster cooperation, the survey was supplemented by questions addressed to SMEs with experience with cluster cooperation. These SMEs should indicate the occurrence of a given indicators in cluster cooperation. They reported the probability of risk indicators occurrence in percentages. According to the results of previous research and the probability of risk indicators occurrence we constructed Key risk indicators matrix (Figure 7).

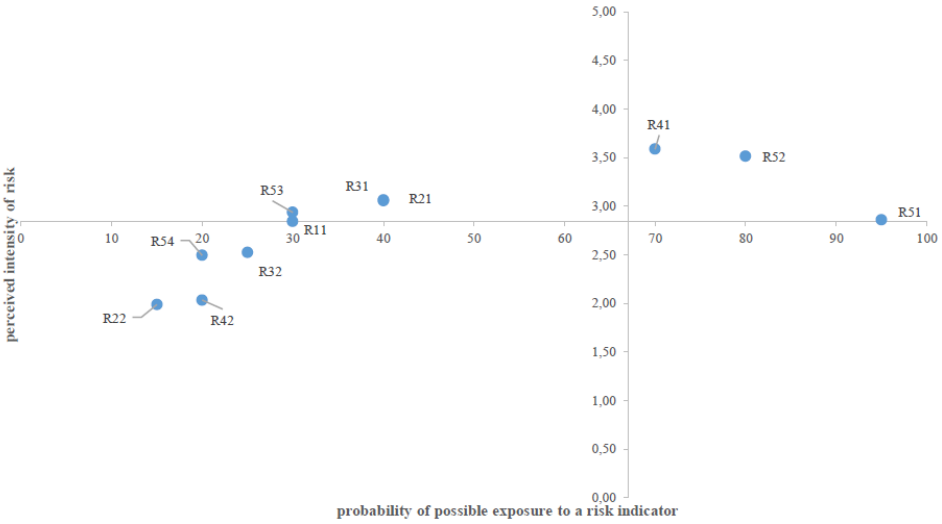

Figure 7. Key risk indicators matrix.

The vertical axis of the key risk indicators matrix expresses a perceived intensity of risk (value 0–5 on Likert scale). The horizontal axis reflects on probability of possible exposure to a risk indicator evaluated by SMEs with cluster experience (%). The matrix is divided into four fields. The vertical line divides the matrix on area with risk indicators with lower intensity and higher intensity. The dividing points were set according study of Kubíčková and Toulová (2013). For horizontal axis it as determined by the intensity of 2.25. The horizontal axis divides the matrix to the area of risk indicators that could occurred with high probability and those with low level of occurrence. The dividing point was chosen 67% or two thirds of SMEs that have experience with cluster cooperation.

There are the key risk indicators of financial risks that are the most important for SMEs in case of cluster cooperation in the top right area of risk matrix. To these risk indicators SMEs should pay attention if they want to join cluster cooperation. *The key risk indicators according results of Key risk indicators matrix are R41, R51 and R52. Furthermore, there were also identified significant risk indicators located near the field of key risks—R21 and R31*. SMEs perception of these indicators is relatively high and probability, that this risks could appear is around 40%. *Our research showed, that key risk indicators belonged mainly to (4) Business risks and (5) Operational risks*. This was observed as important by all categories of SMEs except the small and medium enterprises.

Figure 8 shows the average level of SMEs' perception of most important risk indicators found in our research by Pareto analyses and key risk indicators matrix (R21, R31, R41, R51, R52 and R53.

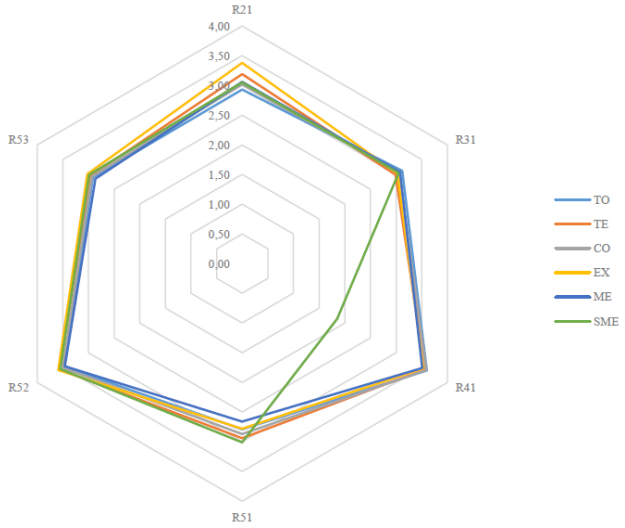

Figure 8. The average perceived intensity of the key risk indicators of financial risks.

Generally speaking, it can be assessed that we cannot observed large differences in perception of risk indicators by all categories of SMEs except the risk indicator R41, which was observed with low average level (1.85) by small and medium enterprises. SMEs with experience with cluster cooperation perceived as the most important risk indicator R52 (3.59) and R 41 (3.53). The highest differences among respondents' perception we can see in case of risk indicator R21 and R51.

The results of this research confirmed the perspective of previous studies of Hudakova et al. (2018) and Belas et al. (2016) and provided future research directions. The overall research results emphasize the importance to deal with the risk management in the context of cluster cooperation not only in Slovakia but also in other countries.

5. Conclusion

The key risk indicators characterizing the financial risk in case of SMEs engagement into cluster cooperation were determined, explored and prioritized. In our research we identified key risk indicators, on which SMEs that want to join cluster cooperation, should mainly be focused on. The most of them belong to Business risk. These are the risk indicators: R21 Commodity risk, R31 Funding risk, R41 Human factor failure, R51 Legal risk, R52 Reputation risk and R53 Taxation risk. They should be considered by SMEs, if they want to join the cluster cooperation. Mainly these risks could impact their future business in cluster.

This research conveys specific issues in the field. It contributes to the widespread of risk management in the specific field—cluster cooperation. The results could contribute to SMEs to decide to join cluster cooperation or not, to other stakeholders in clusters (how can they reduce these potential risks and offer better possibility to cooperate) and for politicians to improve the business environment in case of SMEs' and clusters' business. To this end, it is recommended to improve to optimum condition the business environment in clusters. The results or research project VEGA also

pointed on low level of cluster policy in Slovakia. The risk indicators that characterized the last category of financial risks—Business risk are related also to cluster policy. The problems in this area also confirmed the results in this research.

Based on the findings being obtained, further research will continue and will be devoted to exploring the role of crisis management within the risk prevention assessment regarding the external economic environment having an impact on performance of SMEs.

Conflict of interest

All authors declare no conflicts of interest in this paper.

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