VILNIUS TECH
Vilnius Gediminas Technical University

Journal of Business Economics and Management
ISSN 1611-1699 / eISSN 2029-4433
2022 Volume 23 Issue 5: 1194–1210
https://doi.org/10.3846/jbem.2022.17784

GLOBAL SURVEY OF CURRENT BARRIERS TO PROJECT RISK MANAGEMENT AND THEIR IMPACT ON PROJECTS

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Received 30 September 2021; accepted 01 August 2022

Abstract. The main goal of this contribution is to assess and evaluate the degree to which project risk management is currently applied in companies at the global level based on empirical research. More specifically, it aims to assess the degree to which project risk management is applied during the initiation and planning phases of projects. In 2019, global empirical research was carried out in 31 countries in Europe, Africa, Australia, Asia, and America. In total, 1,143 project managers participated. The research was conducted on the basis of an online questionnaire survey. For the quantitative data analysis, mathematical and statistical data assessment tests were used to process the obtained data. Although the results reveal an increasing interest among top managers in the application of project risk management, they also show that project managers do not apply risk management to every project. The results of this contribution are applicable to managers and project managers in enterprises around the world, especially in European countries. Results highlighted the importance of project risk management and enhancing its application. In this way, managers can potentially reduce the time and financial losses that may affect the successful project realization.

Keywords: risk, project, project risk management, global empirical research, enterprises, project managers, ERM.

JEL Classification: M11, O22, L26, O57.

Introduction

Current trends show an increasing interconnection between project management and some areas of business activity. According to Tavares et al. (2019), project management is currently not only used for the management of complex strategic projects, but also for the improvement of individual business processes. According to several authors, Willumsen et al. (2019), Shayan et al. (2022), in the field of project management, there is a growing need for the effective management of schedules, human resources, costs, and risks. Authors such as Teller

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et al. (2014), Hirsenberger et al. (2019), and other experienced project managers argue that effectively applied project risk management can ensure a reduction in project costs, as well as a lower probability of project failure.

The results of global surveys organized by KPMG (2017) and Project Management Institute [PMI] (2018) confirmed the aforementioned claims. The findings point to the need for risk management, in particular with regard to the improvement of individual processes and the implementation of projects that provide a competitive advantage to companies. Based on the results, it is possible to say, that the main reason projects fail is the poor application of risk management during the planning phase. This covers issues such as the incorrect definition of human resources, the insufficient application of techniques and project risk management tools, inadequate support from top management, and poor communication. The aim of this contribution is to highlight the need and importance of project risk management, as well as to assess the interest of top managers and evaluate the skills of project managers. The focus of the global research is on the evaluation of the application of project risk management across different continents.

The main aim of this contribution is to assess and evaluate the degree to which project risk management is currently applied by companies based on global empirical research. It also aims to assess the degree to which project risk management is applied in the planning phase of projects, the level of support it enjoys from top management, and to what degree risk management techniques and tools are utilised by project managers.

Global research was carried out in 2019 involving a representative sample of 1,143 respondents – project managers in 31 countries in Europe, America. Africa, Australia and Asia. The aforementioned research is original because recent research in this field has been less focused on the assessment of the contemporary state of project risk management.

The introduction of the contribution presents the theoretical background, problems, and shortcomings of project risk management from the perspective of various authors and the results of previous studies and surveys. In the following part, the research questions, hypotheses, and methods used to fulfill the defined goal are specified. The research results are subsequently processed and discussed. The final part of the contribution specifies the benefits of the proposed solution, which can be utilized by project managers around the world.

1. Literature review

In terms of the theoretical background in global scientific literature, there is an increased interest in defining the tasks of project managers more precisely and more comprehensively (Zhang, 2009; Broll & Mukherjee, 2017; Ahmed & Mohammed, 2019). This is due to the need to address the effects that have negative or positive impacts on project management. These impacts are reflected in positive or negative risks (Dvorsky et al, 2021). The role of project managers should therefore involve the identification and assessment of project risks and the proposal of measures to exploit positive risks (opportunities) properly and to reduce negative risks (threats). The more effective the assessment of project risks is in the planning phase of a project, the greater the chance the project implementation will be successful (Abreu et al., 2018).

For a better understanding of this issue, basic terms need to be specified. A project is an essential element of the project management process. It has been defined by many different authors, whose definitions vary according to their own focus, a project, or publication (Teller et al., 2014; Klein & Müller, 2019). The ISO standard (International Organization for Standardization, 2018), which provides guidance on how to properly implement and apply project management within a company, defines a project as a set of unique processes that consist of coordinated and controlled activities with a specified start and end date that have to be performed to achieve the project objectives. Achieving a project's objectives requires the delivery of outputs according to specific requirements. The Project Management Institute (2017b) defines a project as a temporary effort to create a unique product, service, or result. According to Buganová and Šimíčková (2019), temporary efforts mean that each project has a beginning and end. According to Gemünden (2015), a project ends when the project objectives have been met or cannot be met. According to De Bakker et al. (2010), the aforementioned objectives and the success of a project are affected by both positive and negative risks.

Project risk management is defined differently by different authors (e.g. Tavares et al., 2019; Willumsen et al., 2019; Shayan et al., 2022). However, one element is common to the majority of definitions, namely that project risk management is a continuous process of identifying, analysing, prioritizing, and mitigating risks that jeopardize the likelihood of a project's success in terms of cost, schedule, quality, safety, and technical performance (Crispim et al., 2019). The Project Management Institute (2017b) defines project risk management as a set of individual processes focused on risk planning, identification, analysis, management, monitoring, and project risk control. According to Fang and Marle (2012), project risk management is the flexible application of a systematic process to improve the likelihood that a project will achieve its predetermined objectives. According to Hofman et al. (2017), the main objective of project risk management in the initiation phase is to inform top management during their decision-making process about the approval of a project's implementation at a kick-off meeting. Project risk management is a continuous process that begins with a definition and planning phase and ends with a project closure phase (Haniff & Salama, 2016). Several experts, for example, Ayub et al. (2019) and Tavares et al. (2019), claim that project risk management is a complex process that requires skills and experience to carry out the decision-making process.

In 2017, Wellingtone Project Management conducted a survey into the current problems in project management. This involved 768 project managers from 392 organizations. The most important conclusions of the survey were as follows: only 24% of the participating project managers follow project management methodologies; only 30% apply risk management in the project planning process; 32% experience shortcomings, especially in terms of insufficient training in organizations; 28% see a problem in the number of projects implemented per project manager; 23% feel they receive insufficient support from management; 13% believe that risk management is poorly applied; 47.6% use MS Excel to manage projects (Wellingtone Project Management, 2017).

The Project Management Institute conducted a similar survey in 2018 involving 5,402 project managers from around the world. Compared to the previous year, the number of participating project managers that apply technology and risk management tools to project

management had grown (27%). The most frequent causes of project failure were the same as the previous year – changes in priorities (39%), changes in project objectives (37%), and poorly applied risk management (28%) (PMI, 2018). Other possible causes of project failure are in line with the studies of Masso et al. (2020) and Kozhakhmetova et al. (2019), i.e. technical factors, project management-related factors, lack of support from top management, and the lack of participation of project managers. All these aspects undoubtedly make it harder to meet deadlines and achieve budget targets; they can also negatively affect the quality of a project.

Experts claim that risk management is needed in practice. For example, Guan et al. (2020), Klein and Müller (2019), Teller et al. (2014) note that if the risks associated with projects are not appropriately managed, they will have further impacts on the successful completion and course of projects. Effective risk management is therefore of great importance during the life cycle of projects. Masso et al. (2020) claim that risk management plays a key role in project management, as it allows the identification and prompt management of threats that may arise during project execution. The analysis of the study results presented in this contribution also led us to conclude that attention should now be focused on conducting research into one or several activities within the risk management process. Reed and Angolia (2018) assert that in a number of studies, this management is considered to be one of the main factors influencing the success of projects.

It can be stated, on the basis of the results from global surveys, that one of the main contributory factors to project failure is the inadequate application and underestimation of risk management. This is reflected in the inability to manage individual changes within a project. Managers apply risk management steps in individual methodologies or standards, inconsistently. They often identify risks only based on their feelings. For the effective application of risk management in projects, it is recommended to use various standards, techniques, and tools. Currently, there are many individual standards and tools for project management, each designed to effectively assess project risks within a company. Many standards and tools currently target different management sectors, but there are very few risk management projects.

There are currently only a few organizations that conduct surveys directly focused on the contemporary application of project risk management. Alternative surveys focus either on project management or risk management (Project Management Institute, 2017b).

2. Research methodology

Various scientific methods were applied to gain the stated objective of this contribution, namely a questionnaire survey and statistical methods for data evaluation.

The online questionnaire survey enabled targeted global research to be carried out, as well as the more efficient collection, sorting, and evaluation of the data in terms of time, location, and response speed. The questionnaire was created using the Google Form platform, which provides a suitable environment for questionnaire creation, data collection, sorting, and export to MS Excel, as well as the easy evaluation and presentation of the results (Wiemken et al., 2018).

The created questionnaire consisted of three parts: Part 1 – Basic elements of project management; Part 2 – Application of project risk management; and Part 3 – Software packages for project risk management. The first part of the questionnaire focused on the selected primary methodologies and tools and their application in project management, the level of standardization within the company, and the skills of the project managers. The second part of the questionnaire focused on the use of project risk management methodologies and tools. The third part of the questionnaire dealt with the identification of software packages.

The use of a questionnaire survey corresponds to the main aim of this contribution, i.e. to assess and evaluate the current situation with regard to the application of project risk management in enterprises worldwide. The composition of the questions was based on the authors' own experience with the aforementioned issues within the framework of projects and research already undertaken, an analysis of the current situation in the world with regards to the issue at hand, and work experience. The questionnaire consisted of 21 questions.

The significance of the representative sample was calculated according to the Cochran formula, and the number of respondents in the sample set according to Dans and González (2018) (confidence level 95%; acceptable error tolerance 5%; and the estimated number of project managers worldwide, 15,000,000).

The statistical targeted statistic sample consisted of project managers, who carry out projects in enterprises worldwide. The majority of project managers were from Europe (66.2%), followed by America (14.8%), Africa (11.7%), Australia and Asia (7.4%). The questionnaire was distributed through several social networks (e.g. LinkedIn®, Academy of International Business, and projectmanagement.com).

For quantitative data analysis purposes, the obtained data were subjected to data analysis tests. The sphericity of the sample size was calculated using Barlett's test. Barlett's test of sphericity considers $p < 0.5$ to be a significant value. The higher the value, the better the test's performance ($p > 0.6$) (Özdemir et al., 2018; Wang et al., 2014; Azizan et al., 2011). Tests were also performed to assess the quality of the data, as well as to verify the calculation. These included the two-tailed test and Anderson-Darling test. Descriptive statistics and analysis of variance (ANOVA) statistics were also used to assess the data.

Grubb's test was subsequently applied to remove extremes that could distort the results. To assess the dependence between the variables, correlation analysis and the Chi-square test for assessing significant differences by averaging were used. The statistical analysis and output data were calculated in MS Excel using custom-created macros.

The Chi-square test of dependence was used to analyse the qualitative data. According to Guetterman (2019), the Chi-square test is designed to calculate the dependence between two qualitative values, and to do this it is necessary to determine the individual hypotheses for subsequent verification. A definition of the level of reliability is also needed.

On the basis of the processed baseline analysis, i.e. the analysis of knowledge from global scientific literature, analysis of the current application of project risk management worldwide, and the analysis of the results of own surveys, the objectives of this contribution were specified. These objectives are reflected in the research questions, which form the basis for the hypotheses.

Q1: Is there a statistically significant difference between the use of risk management tools by project managers and the level of risk culture within a company?

Q2: Which method is most commonly used for identifying project risks?

Q3: Which method is most commonly used for project risk analysis?

Hypothesis 1: There is a statistically significant difference in the use of risk management tools by project managers and the level of risk culture within a company.

Hypothesis 2: Project managers mostly utilise brainstorming to identify project risks.

Hypothesis 3: Project managers mostly utilise interviews and estimates of the consequences and the probability of the occurrence of a negative event for project risk analysis.

The results of the research presented in this contribution verified the established hypotheses. It was needed to set research limitations to carry out the research successfully. The representative sample, therefore, consists of project managers from around the world.

3. Results

In total, 1,143 project managers participated in the research, of which 18.1% worked in small companies, 56.9% in medium-sized companies, and 25.0% in large companies. The majority of the project managers worked in the manufacturing sector (78.5%), followed by the IT sector (5.8%), agricultural sector (5.8%), and public services sector (3.9%).

The statistical sample consisted of 21,409 numeric characters and 64,774 – word characters, which were further analysed. With regards to the defined research area, the research sample consisted of 1,143 project managers worldwide.

Hypothesis testing – Hypothesis 1

Several surveys, the results of which are referenced in this contribution, identify the lack of interest in risk management among top managers, not only in terms of the application thereof but also within the company culture. This may be considered the biggest reason for project delays and failures, as well as the primary cause of competitiveness problems. Several authors (Besner & Hobbs, 2012; Buganová & Šimíčková, 2019; Kozubikova et al., 2019) agree that when the risk culture within a company is low, managers utilise fewer risk management tools. Hypothesis 1 was formulated on the basis of these findings, i.e. there is a statistically significant difference in the use of risk management tools by project managers and the level of risk culture within a company.

The results of our research also point to the low use of risk management tools (only 20% of project managers – Table 1). However, a majority use qualitative risk management tools (76.30%), with a minority using quantitative risk management tools (23.7%). The results simultaneously show that only 7.31% of top business managers help establish and embed the risk culture of a company; promote open discussions regarding risk (Table 2). Irregular support from top management occurs in approximately 8 out of 10 companies. In terms of geographical location, the greatest support was identified in America (19.61%), whilst the lowest was in Europe (8.23%).

The correlation between the use of risk management tools by project managers and the level of risk culture in a company was also assessed. The data assessment revealed a low cor-

relation. Tschuper's correlation coefficient was 0.17 and Pearson's correlation coefficient was 0.18. Data assessment, in terms of the outputs, and on the basis of an analysis of variance, identified medium variance for the selected individual data. Statistical significance was assessed through the application of the two-tailed test and confirmed (p-value = 0.0031), but is less than the established level of confidence of 0.05 (Table 1).

Based on the processed results, hypothesis 1 was confirmed: there is a statistically significant difference in the use of risk management tools by project managers and the level of risk culture within a company.

Table 1. Descriptive statistics for hypothesis 1 data (n = 1,143) (source: own calculations)

Correlation				
No.	1	2	3	4
1	1.0000			
2	0.6587	1.0000		
3	0.2922	0.8921	1.0000	
4	0.2654	0.6998	0.2377	1.0000
BSC	Tools PM	Schedule PM	Cost PM	Risk PM
Mean	0.3601	0.3669	0.3077	0.4199
Standard Error	0.2554	0.0063	0.0051	0.0040
Median	0.1931	0.0297	0.3601	0.2009
Standard Deviation	0.5555	0.1582	0.0668	0.1795
Kurtosis	79.0132	3.9945	–0.2609	–0.0978
Skewness	33.5550	1.1821	0.2208	0.5600
Range	32.0014	0.9066	0.8005	0.9030
p-value = 0.0031				

Hypothesis testing – Hypothesis 2

In terms of the application of project risk management, the most frequent problem is that managers are not able to appropriately utilise individual techniques and tools. According to Buganova & Simickova (2018), the most common problems are a lack of understanding of the application procedure, a lack of time to apply the procedure, and insufficient adaptation of the project manager's techniques and tools. Hypothesis 2 was formulated on the basis of the aforementioned and the processed baseline analysis, i.e. project managers mostly utilise brainstorming to identify project risks.

There are many techniques and tools that can be used for the process of risk identification. With regards to the given hypothesis, the most commonly used risk management techniques and tools were selected by the project managers. This can be explained by the level of occurrence of the three most common responses, namely brain-storming, Ishikawa diagram, and SWOT analysis, which combined represent 41.79% of the responses (Table 2). Both Pearson's correlation coefficient and Tschupre's correlation coefficient indicated almost no dependence (0.0996). At the same time, statistical significance was confirmed based on the two-tailed test

(p-value = 0.0008). Correlation analysis identified a very strong correlation between brainstorming and SWOT analysis (Table 3), and weaker correlations between brainstorming and system/process flow charts, brainstorming and the Ishikawa diagram, brainstorming and root cause identification, and brainstorming and the cause and effect diagram.

From the perspective of risk management techniques and tools, it is clear that project managers possess sufficient knowledge of them. The least applied techniques and tools were requirement analysis (only 2.06% of project managers) and system/process flow charts. Conversely, most project managers apply brainstorming (15.01%), SWOT analysis (13.50%), and the Ishikawa diagram (13.02%) (Table 2).

Table 2. Most utilised project risk identification techniques or tools (n = 1,143) (source: own calculations)

No.	Most utilised project risk identification techniques or tools	Count		Cumulative count	
		Absolute	Relative	Absolute	Relative
1	Brainstorming	466	0.150129	466	0.150129
2	SWOT Analysis	419	0.134987	885	0.285116
3	Ishikawa Diagram	404	0.130155	1289	0.415271
4	Interviews	386	0.124356	1675	0.539626
5	Delphi Technique	272	0.087629	1947	0.627255
6	Documentation Review	224	0.072165	2171	0.69942
7	Other	208	0.06701	2379	0.76643
8	Root Cause Identification	204	0.065722	2583	0.832152
9	Checklist Analysis	146	0.047036	2729	0.879188
10	Influence Diagrams	139	0.044781	2868	0.923969
11	Cause and Effect Diagram	104	0.033505	2972	0.957474
12	Assumptions Analysis	68	0.021907	3040	0.979381
13	System/Process Flow Chart	64	0.020619	3104	1
	Summary	3104	1	X	X

Based on the processed results, hypothesis 2 was confirmed: project managers worldwide mostly utilise brainstorming to identify project risks. It should be pointed out that project managers can also use brainstorming as a part of other techniques and tools, for example when applying the Ishikawa diagram. SWOT analysis, etc. The partial results show a growing trend in the application of brainstorming on all continents (Europe 16.41%; Africa and the Middle East 20.11%; Australia and Asia 14.89%; America 21.16%).

Hypothesis testing – Hypothesis 3

Based on several global surveys, project managers mostly underestimate the value of risk analysis, either due to a lack of time or a general misunderstanding of its importance (KPMG, 2018; PMI, 2017a, 2018). This often leads to an incorrectly performed risk analysis and evaluation. It is on this basis that hypothesis 3 was formulated, i.e. project managers mostly utilise interviews and estimates of the consequences and the probability of the occur-

Table 3. Correlation between selected project risk identification techniques or tools (n = 1,143) (source: own calculations)

No.	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.0000												
2	0.7983	1.0000											
3	0.2307	0.0677	1.0000										
4	0.0987	0.1099	0.0411	1.0000									
5	0.1045	0.0365	0.0909	0.0918	1.0000								
6	0.1898	0.1009	0.0053	0.0929	0.0481	1.0000							
7	0.0024	0.0865	0.0917	0.0565	0.0368	0.1501	1.0000						
8	0.2065	0.1041	0.0882	0.1340	0.0925	0.0765	0.0551	1.0000					
9	0.1598	0.0395	0.0091	0.0297	0.0819	0.1495	0.0679	0.0554	1.0000				
10	0.0602	0.0495	0.0829	0.2175	0.0359	0.1974	0.0060	0.0679	0.2198	1.0000			
11	0.2506	0.0502	0.0265	0.1098	0.0740	0.2363	0.0290	0.0990	0.0288	0.0665	1.0000		
12	0.2030	0.2274	0.1789	0.1745	0.0760	0.0266	0.2388	0.0770	0.0747	0.0034	0.2192	1.0000	
13	0.3055	0.0373	0.1414	0.0565	0.2043	0.0744	0.21987	0.2327	0.0747	0.0240	0.0201	0.0570	1.0000
p-value = 0.0007													

rence of a negative event for project risk analysis (Table 4).

Table 4. Most utilised project risk analysis techniques or tools (n = 1,143) (source: own calculations)

No.	Most utilised project risk analysis techniques or tools	Count		Cumulative count	
		Absolute	Relative	Absolute	Relative
1	Risk Probability and Impact Assessment	615	0.129474	615	0.129474
2	Interviews	602	0.126737	1217	0.256211
3	Sensitivity Analysis	585	0.123158	1802	0.379368
4	Probability and Impact Matrix	574	0.120842	2376	0.500211
5	Risk Data Quality Assessment	561	0.118105	2937	0.618316
6	Risk Categorization	362	0.076211	3299	0.694526
7	Probability Distributions	351	0.073895	3650	0.768421
8	Expert Judgement	315	0.066316	3965	0.834737
9	Other	213	0.044842	4178	0.879579
10	Modelling and Simulations	214	0.045053	4392	0.924632
11	None	141	0.029684	4533	0.954316
12	Risk Urgency Assessment	120	0.025263	4653	0.979579
13	Decision Tree Analysis	97	0.020421	4750	1
	Summary	4750	1	X	X

In terms of project risk analysis tools, it is clear that project managers are sufficiently aware of their application. The least applied tools are decision trees, risk urgency assessments, expected value estimation (EMV), modelling, and simulation. These tools are more suitable for the risk analysis of projects with longer implementation times. For projects, project managers mostly utilise estimates of the probability of the occurrence of a negative event, the consequences of risks (in quantitative analysis), and interviews (in qualitative analysis). Both Pearson's correlation coefficient and Tschupre's correlation coefficient showed almost no dependence (0.0489). At the same time, statistical significance was confirmed using the two-tailed test (p-value = 0.0682). Correlation analysis (Table 5) revealed a strong correlation between risk probability and impact assessment and interviewing, with weaker correlations between risk probability and impact assessment, modelling and simulation, interviewing and risk categorization, interviewing, and other methods. tools and techniques, and sensitivity analysis and risk data quality assessment.

Based on the processed results, hypothesis 3 was refuted. In fact, most project managers utilise risk probability and impact assessment (Table 4). Risk data quality assessment, risk probability and impact assessment are most commonly used in America, whereas this is limited to risk probability, and impact assessment in Europe, Africa, Australia and Asia.

Table 5. Correlation between selected project risk analysis techniques or tools (n = 1,143) (source: own calculations)

No.	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1.0000												
2	0.8247	1.0000											
3	0.0284	0.0242	1.0000										
4	0.1087	0.0403	0.1701	1.0000									
5	0.0161	0.058	0.2403	0.04	1.0000								
6	0.0465	0.2115	0.0225	0.0778	0.0064	1.0000							
7	0.0577	0.1512	0.0805	0.2279	0.1526	0.0178	1.0000						
8	0.0125	0.1658	0.1343	0.0933	0.0453	0.1037	0.0706	1.0000					
9	0.0739	0.2348	0.0181	0.0849	0.0034	0.0627	0.1408	0.0041	1.0000				
10	0.2208	0.1069	0.0206	0.0739	0.1131	0.0377	0.1104	0.0073	0.1638	1.0000			
11	0.0316	0.071	0.0046	0.1183	0.0004	0.2044	0.108	0.0688	0.0077	0.0030	1.0000		
12	0.0328	0.014	0.1192	0.2772	0.2243	0.0476	0.1122	0.0256	0.0417	0.1118	0.0039	1.0000	
13	0.0929	0.1063	0.2208	0.0607	0.2002	0.0051	0.0101	0.124	0.0123	0.0016	0.1656	0.0009	1.0000
p-value = 0.0682													

4. Discussion

The results of such research reveal that managers are not able to adequately apply risk analysis to the project management process and to individual company processes. They do not focus on prevention and often only deal with the consequences of negative events.

These findings mainly apply to the surveys by the Wellington Project. Project Management Institute and PWC. as well as to those of authors such as Besner and Hobbs (2012), Tereso et al. (2018), and others.

Besner and Hobbs (2012) processed their results based on a representative sample of 2,339 respondents from around the world. Their research dealt with the degree to which project management tools are utilised in practice. Tereso et al. (2019) processed their results based on a representative sample of 159 respondents. Their research was focused on the application of various methods, tools and procedures in the field of project management.

According to the results of our research, and specifically in relation to *hypothesis 1*, it can be stated that there is a statistically significant difference in the utilisation of risk management tools by project managers and the level of risk culture within a company. According to the Wellington Project Management results, only 23% of project managers feel they receive inadequate management support. The results of the survey conducted by Tereso et al. (2018) point to the need to innovate the project management process within a company and to pay more attention to project risk management. Confirmation of hypothesis 1 also complements the results of Willumsen et al. (2019) and Hirsenberger et al. (2019), who highlight the need to apply project risk management in order to enable companies to reduce project costs, but also reduce the likelihood of project failure. From the results of the survey conducted by Besner and Hobbs (2012), it can be concluded that the lack of any interconnection between a project and risk management can negatively affect not only the quality but also the time and costs of project implementation. Top management must therefore have a clearly defined policy and structure for the application of risk management, as well as promote a positive attitude towards risk management within the company. The expectation is that top management, especially in European countries, should provide more support for the application of project risk management and its integration into the company culture. The processed results can be compared with the results of the Wellington Project Management survey of 2017, according to which only 30% of project managers apply risk management in the project planning phase. The results of the survey conducted by Tereso et al. (2018) also point to only a slow increase in the application of project risk management in companies worldwide. This may be affected by the fact that top management does not provide project managers with sufficient training in this area. In other words, project managers lack sufficient experience and knowledge of the application of specific methods, techniques, and tools. This assumption is confirmed by the results of the survey conducted by PWC (2018), according to which only 52% of project managers can manage risks in their projects. According to Tavares et al. (2019), Willumsen et al. (2019), and Shayan et al. (2022), it is not only necessary to effectively manage project costs, human resources and time schedules, but also increasingly the risks associated with the implementation of a project within a company. Based on these results, and our results, it

is possible to confirm the established hypothesis – there is the difference in the utilisation of risk management tools by project managers and the level of risk culture within a company.

Hypothesis 2 confirmed that the most commonly used method for identifying project risks is brainstorming, followed by the Ishikawa diagram and SWOT analysis. According to Avlijaš and Radunović (2019), brainstorming is considered to be a basic and simple method for identifying risks, not just project risks. The results of a survey conducted by Tereso et al. (2018) point to a lack of experience and knowledge in terms of the application of specific methods, techniques, and tools. There is a need for education in the implementation and application of complex methods, techniques, and tools. According to their survey results, the most commonly applied techniques and tools for identifying project risks are Gantt charts, baseline planning, and meetings. Similar results were obtained by Thaheem and De Marco (2013) in their "Survey on the Usage and Diffusion of Project Risk Management Techniques and Software Tools in the Construction Industry". The most commonly used methods to identify project risks were found to be documentation assessment (72%), brainstorming (64%), and checklists (48%). From the results of the individual surveys, it can be concluded that project managers use brainstorming and consulting the most, thereby applying other techniques insufficiently and showing a reluctance to apply complex methods. This is reflected in the results of a survey conducted by Besner and Hobbs (2012), who concluded that project managers often apply brainstorming and meetings, do not apply techniques correctly, and show an unwillingness to apply complex methods. Based on these results, and our results, it is possible to confirm the established hypothesis – project managers worldwide mostly utilise brainstorming to identify project risks.

Hypothesis 3 confirmed that project managers mostly utilise intuition and estimates of the consequences and the probability of the occurrence of a negative event for project risk analysis. Once again, the results can be compared to those of the global surveys by PMI (2018) and KPMG (2017), which revealed that the most commonly utilised techniques and tools for project risk analysis were interviews (qualitative analysis) and estimates of the consequences and the probability of negative events (quantitative analysis). The results of Besner and Hobbs (2012) also indicate that in practice, the application of qualitative rather than quantitative methods prevails among project managers. According to Thaheem and De Marco (2013), in terms of qualitative analysis. the assessment of the consequences and the probability of the occurrence of negative events (66%) and risk categorization (35%) were mostly applied. In terms of quantitative analysis, this was expert assessment (64%) and interviews (44%).

The successful application of methods, techniques, and tools for risk management is to some extent dependent on the nature of the project and largely on the knowledge and time of the project manager. This is corroborated by others. Ayub et al. (2019), Rabechini and Monteiro de Carvalho (2013) and De Bakker et al. (2010). The need to continuously improve one's knowledge and experience of the identification, analysis, and/or evaluation of risks, but also the ability to propose measures to reduce them using appropriate techniques, tools, and/or software tools. Can therefore be considered confirmed. Based on these results, and our results, it is possible to refute the established hypothesis. In fact, most project managers utilise risk probability and impact assessment.

Conclusions

In recent years, the link between project management and various business activities has been established, improved, and developed. The turbulent economic environment requires the introduction of specific changes within companies, in particular with regards to the streamlining of production processes, in order for them to continue generating profits and grow. Current trends within the field of project management point to the need to deal with the issue of project risk management. It is primarily project managers that utilise risk management in the planning phase of projects. According to mentioned authors and the results of global surveys, the initiation and planning phases of a project are characterized by a high level of risk occurrence. It is, therefore, necessary to identify, assess and evaluate those risks and reduce the potential losses, which may inflict on a project during its lifecycle.

The results of the research presented here, when compared to those of global surveys, can add the following contributions:

1. There is a statistically significant difference between the utilisation of risk management tools by project managers and the level of risk culture within a company.
2. For the identification of project risks, project managers mostly apply qualitative risk analysis in the form of brainstorming.
3. For project risk analysis purposes, project managers mostly apply quantitative analysis in the form of risk probability and impact assessment.

The processed results contribute to the greater theoretical and practical integration of two important approaches to business management, i.e. risk management and project management. This contribution gives important insight into the current application of project risk management in terms of project implementation within companies worldwide. The results of the research increase awareness of the issue and are intended to highlight the need for the project risk management application among top managers. Within this context, top managers are expected to continuously support and integrate project risk management into corporate culture. At the same time, project managers are expected to acquire knowledge and experience, as well as be committed to not only the identification, analysis, and/or evaluation of risks, but also to propose measures to reduce the impacts thereof using appropriate tools and techniques with software support. The effective application of project risk management increases the prospects of successful project completion on time, at cost, and with the desired quality of outputs. It enables the identification and resolution of potential risks, which may affect a project not only in the design phase but in all project lifecycle project stages, too. Project risk management should therefore be a strategic tool in every project-oriented company.

The limitations of the research are in its focus on projects and specific phases of the project lifecycle – initiation and planning phases. The results are valuable for further research into long-term projects and all phases of the project lifecycle. The main contribution of the research lies in the summary and evaluation of data from several countries around the world.

The results also provide a basis for further research into project risk management. Future studies should investigate the current state of project risk management in other project lifecycle phases. Consideration should also be given to the study of the project risk manage-

ment application in various other industries with a view to developing specific project risk management models. In this way, it will be possible to improve the ability of project managers to run projects more effectively, as well as improve company competitiveness.

Funding

Publication of this paper was supported by the Scientific Grant Agency – Project VEGA No. 1/0243/20 – Integrated risk management system in the changing business environment in Slovakia.

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