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BARRIERS OF KNOWLEDGE BASE CREATION IN THE CONTEXT OF MICROSOFT PROJECT APPLICATION

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ABSTRACT

The paper presents the results of an empirical research aimed at determining the level of practical usage of the Microsoft (MS) Project application as a suitable knowledge base for project management support. The main research aim is to identify the barriers to the creation of a knowledge base in the context of Microsoft Project applications. To fulfil the aim of the paper, a questionnaire survey in the form of a guided interview was conducted and two statistical hypotheses were formulated (H1, H2). The research was conducted in the selected region in the Czech Republic, using a sample structure that is a representative sample of the population structure. The research results confirm that there are barriers to creating a knowledge base in the context of Microsoft Project application. These barriers are categorized into three groups: significant, medium, and moderate. The classification is primarily based on the view of insufficient centralization of data, information and knowledge related to key project processes (time planning, resource allocation, budget composition, project status evaluation, and project risk management). The most important obstacles include: MS Project application is used in the project-planning phase only for project time analysis (not for resource and cost analysis); MS Project application is not used in the project realization phase (lack of project baseline, evaluation of project status). Medium barriers include: incomplete initial project setup; failure to use lag time and lead time for dependencies between tasks; failure to use task constraint types; failure to use the function "Effort-Driven Task". Moderate barriers include: failure to enter project metadata; failure to use shared project resources; failure to use custom reports.

KEYWORDS: *Project management, Microsoft Project application, knowledge management, knowledge base.*

1. INTRODUCTION

The need to possess relevant data, information and above all knowledge of a particular project is one of the prerequisites of successful project management (Pagano & Blair, 2014). Knowledge is the fundamental building block that facilitates the planning and management of key project processes (Ekrot et al., 2016; Frank & Duarte Ribeiro, 2014). The lack of this knowledge leads to purely chaotic behaviour that can hardly be described as management. In the long run, such behaviour may have a critical impact on project management applications in certain companies. The existence of a functional and updated knowledge

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base of project management (Relich et al., 2014), adjusted to the needs of the respective company, is an absolute necessity for high-quality and efficient project management (Kostalova et al., 2015). In this way, knowledge about the projects can be maintained and shared and new knowledge can be identified. Knowledge management thus plays an important role in modern project management (Nino et al., 2015; Todorović et al., 2015; Khan & Rasheed, 2015). From a knowledge management perspective, knowledge can be divided into tacit and explicit knowledge (Woolliscroft et al., 2013). This classification should also be applied to knowledge management in the context of project management (Zhang et al., 2013). The best practice of knowledge creation in the context of project management means applying the process of knowledge creation practically, e.g. according to the principle of the SECI model (Anshari & Hamdan, 2022; Babic et al., 2022). Its knowledge dimensions (S - Socialization, E - Externalization, C - Combination and I - Internalization) activate the basic knowledge management processes such as knowledge discovery, capture, sharing, application, creating, acquiring, articulating, and systematizing.

Previous research (Hwang & Ng, 2013; Rwelamila & Purushottam, 2012) suggests that there are often problems with both project-based learning and the transfer of learning from projects to the organization as a whole. Knowledge management in project management defined, e.g. according to PM BOK (Project Management Institute, 2017), does not work or does not work properly. Solving these problems requires, above all, a systematic approach and effective use of the principles of knowledge management (Pivec & Potocan, 2021) in creating a knowledge base in projects.

The main research aim is to identify the barriers to the creation of a knowledge base in the context of the use of Microsoft Project application. The paper presents the results of an empirical research aimed at establishing the level of practical usage of the Microsoft Project application as a suitable knowledge base to support project management during the project life cycle: pre-project, planning, realisation, completion, post-project (Doskocil & Lacko, 2019; Kostalova & Tetrevova, 2016).

Several specialized software applications are available on the market to support efficient project planning and project management (e.g., Powerproject, ProjectLibre, Clarizen, Redmine, Primavera Project Planner, Powerproject, OpenProj, TimeMaker). Microsoft Project is the most widely used application on the global scale. It is becoming the universal standard for project planning and management (Bjelica et al., 2012; de los Angeles Suarez-Medina & Astudillo-Enriquez, 2013; Ferreira & Tereso, 2014; Hanigan, 2013; Chen et al., 2003; Kazovic & Valencic, 2013; Nae et al., 2012, 2014). It has been continuously developed. The current version is Microsoft Project 2021. For these reasons, the research focuses on the analysis of Microsoft Project application.

1. LITERATURE REVIEW

The research by Chernyakhovskaya & Nizamutdinov (2019) addresses the problem of organizing the intellectual decision making support in innovative project management based on the knowledge base. The authors present an approach to the development of knowledge base for intellectual decision support in innovative project management based on the ontological analysis of knowledge acquisition from various sources. One of the main characteristics of knowledge management systems is emergence, due to which the interaction between specialists based on the formalization of knowledge representation and processing in the development of intellectual components (ontology knowledge base) contributes to the creation of new knowledge. They proposed to develop a comprehensive tool for the development of an integrated model for knowledge representation and processing at various stages of the innovative project management process based on ontological engineering. The research by Milosevic et al. (2019) explores the impact of perceived top management involvement and knowledge sharing on perceived project performance. The relationships were examined with a sample of CEOs, directors and project managers from a large international bank. The results show that the "human factor" is critical to project success.

The research by Kozlowski & Matejun (2016) presents the characteristic features of project management in small and medium-sized enterprises. With regard to the use of organizational tools, the results of their study show that SMEs are less inclined to use organizational tools and tend to make less use of computer software to support project planning.

The research by Otalora Luna et al. (2018) presents the proof of concept of a proposed architecture that allows the construction environment to automate the activities of planning, monitoring, and controlling of a project, with the integration of workflow tools and scheduling of projects. The proposed architecture was implemented on the Intalio tool as a workflow and Open Project as a scheduling tool. The business process management platform enables the coherent integration of process tasks to update the scheduling tool in real time. The proposed integration allows to feed a knowledge base from which the system auto-

matically proposes a new schedule for the pending activities, depending on the actual progress of the project.

The research by Babic & Curova (2017) proposes a new web-based system to support project management with some traditional and some new features, e.g., a knowledge base. They focused on small companies dealing with customer orders and task distribution between internal and external employees (e.g., a developer, a graphic designer, and an SEO analyst). They proposed a solution based on a detailed analysis of the existing competitive solutions against predefined criteria and identified a list of user requirements gathered in close cooperation with potential customers. The result is a customized web-based system with an intuitive and user-friendly interface and a comprehensive list of features, from which the implemented knowledge base stands out.

The research by Cheng et al. (2016) analyses the problems that exist in the current science and technology project management. The analysis was conducted using big data and information technology such as the Internet of Things and cloud computing. They were combined to present the characteristics of science and technology project management. The knowledge base of scientific and technological project management was presented by describing the principle of the hierarchical structure of project management based on big data. Using the data knowledge, it serves for the decision of scientific and technological project management from the perspective of the company implementing the project.

Research by Settas & Stamelos (2007) proposes the Software Project Management Antipattern Intelligent System (PROMAISE) as a Web-enabled, knowledge-based framework that uses antipattern OWL ontologies to provide software project managers with intelligent and up-to-date advice to select appropriate antipatterns in a software project. Antipatterns provide information about common solutions to problems that have negative consequences. These mechanisms are documented in informal, paper-based structures that do not readily support knowledge sharing and reuse. The Antipattern OWL ontology can be used to build a dynamic antipattern knowledge base, which can update itself automatically.

In their study, Hemeid & Wahba (2003) proposed a tool for project management based on knowledge management. It includes four components: the project management knowledge process diagram, the knowledge base, the knowledge threshold matrix and the knowledge reference card. The tool helps project managers to understand the project management processes, the project management knowledge areas and the preferred level of knowledge in each knowledge area and to define the project management evaluation.

2. RESEARCH METHODOLOGY

2.1. Research design

Quantitative and qualitative research methods were used to define the research objective. The quantitative research was performed in the form of a targeted questionnaire survey and supplemented by qualitative research in the form of a structured and semi-structured interview (Doskočil, 2016).

The questionnaire consisted of 17 questions and was targeted precisely at the defined research aim. The respective parts of the questionnaire focused in particular on the following areas: setting up the initial project, planning project tasks, planning project resources and costs, monitoring project progress, and project reporting.

The appropriate conciseness and overall simplicity of the questionnaire, not at the expense of the possibility to obtain relevant data on the defined research aim was an important factor in its creation. A questionnaire prepared in this way has a higher probability of obtaining high-quality input from the respondents. Most of the questions in the questionnaire offered a single-choice answer selected from a maximum of five options. The main reason for defining the questionnaire in this way was the possibility of its later statistical analysis.

Two statistical hypotheses were formulated in order to achieve the defined research aim of the paper:

H1: There is a dependency between the level of utilisation of software support for project management and the ability to create the knowledge base to support project management.

H2: There is a dependency between the degree of utilisation of software support for project management and project success.

2.2. Data collection

The database "Technological Profile CR" (Czech Republic) of the Association of Innovative Entrepreneurship CR Company (2021) was used as the primary source for the identification of basic data on entrepreneurial subjects (organisations, companies). The database contains contact details of more than 2,000 entrepreneurs from the Czech Republic, who are engaged in innovative activities. The ability to innovate, i.e. the ability to continuously create and implement efficient

innovation processes, is conditioned, among other things, by active project management applications. Owing to this prerequisite, the above-mentioned database was also suitable for the defined research aim. The data are available in the classification according to the regions and districts of the Czech Republic (rough selection). Detailed selection provides data in the structure: organization number, contact person, identification number, address, branch, technology, type of company.

The Vysočina region was selected for the empirical research. One of the main reasons was the researcher's good knowledge of the region. This fact has a positive effect on the relevance of the data collected in the questionnaire survey using the questionnaire survey method and directed interviews. The second reason was the fact that the selected region provides a statistically sufficient data sample for the defined research aim.

The population structure (see Table 1) includes 117 companies. It was described by the following factors:

- Geographical perspective – five districts within the analysed region.
- Expansion perspective – the number of companies within the analysed region and its individual districts.
- Branch perspective – classification of economic activities (CZ-NACE).

TABLE1: Structure of the population

CZ-NACE/Districts	Pelhřimov	Havlíčkův Brod	Jihlava	Třebíč	Žďár nad Sázavou	**Vysočina Region**
Agriculture	1	1	0	0	0	**2**
Fishing, breeding ponds, related activities	0	2	0	0	0	**2**
Food and beverage production	0	1	1	0	0	**2**
Textile industry	0	1	0	0	0	**1**
Clothing industry, fur processing and dyeing	0	1	0	0	0	**1**
Tanning and finishing leather, manufacture of bags, saddles and footwear	0	0	1	0	0	**1**
Wood and cork industry	1	0	0	1	2	**4**
Pulp, paper and paperboard production	0	0	0	2	0	**2**
Publishing, printing and reproduction	0	0	0	0	1	**1**
Manufacture of chemical products	1	1	2	0	1	**5**
Manufacture of rubber and plastic products	0	1	1	1	4	**7**
Manufacture of other non-metallic mineral products	0	1	1	0	1	**3**
Manufacture of metals including metallurgy processing	0	0	0	0	1	**1**
Manufacture of metal structures	9	7	5	5	7	**33**
Manufacture of machinery and equipment	7	10	4	5	9	**35**
Manufacture of electrical machinery and equipment	1	4	7	1	3	**16**
Manufacture of radio, television and communication equipment and devices	0	1	3	1	1	**6**
Manufacture of medical equipment, precision instruments and optical chronometers devices	0	1	1	1	2	**5**
Manufacture of two-track motor vehicles and trailers	2	1	16	0	2	**21**
Manufacture of other transport equipment	1	0	0	0	2	**3**

CZ-NACE/Districts	Pelhřimov	Havlíčkův Brod	Jihlava	Třebíč	Žďár nad Sázavou	**Vysočina Region**
Manufacture of furniture; other processing industry	0	0	0	1	1	**2**
Construction industry	2	2	2	4	2	**12**
Sale, repair and maintenance of motor equipment and trailers	3	0	0	0	0	**3**
Retail trade, repair of consumer goods	3	4	2	2	8	**19**
Wholesale trade, commission trade	3	10	4	7	4	**28**
Hotels and restaurants	2	1	1	1	1	**6**
Land transport, transport via pipelines	1	1	2	0	1	**5**
Renting of machinery and equipment without operating staff	1	0	1	1	0	**3**
Data processing and related business	0	1	2	4	4	**11**
Research and development	0	5	2	0	0	**7**
Service providing mainly to businesses	5	10	3	10	6	**34**
Education	0	0	1	1	0	**2**
Wastewater and solid waste removal	0	1	0	0	2	**3**
Other services	0	2	0	0	1	**3**
Overall representation of companies [number]	**18**	**28**	**24**	**19**	**28**	**117**

SOURCE: The World Bank online data

TABLE2: Structure of the sample

Characteristics/Districts	Pelhřimov	Havlíčkův Brod	Jihlava	Třebíč	Žďár nad Sázavou	**Vysočina Region**
Companies [number]	18	28	24	19	28	117
Companies [%]	15	24	21	16	24	100
Contacted companies – respondents [number]	7	11	10	8	11	47

SOURCE: own processing based on (Doskočil, 2016)

The structure of the sample (see Table 2) was determined based on the basis of knowledge of the population structure (see Table 1) using the same factors as the population structure, i.e.:

- Geographical perspective – the respective districts within the Vysočina region.
- Expansion perspective – the number of companies within the Vysočina region and its individual districts was determined to be at the level of 40%, i.e. 47 companies, which is statistically sufficient (Saunders et al., 2023).
- Branch perspective – classification of economic activities (CZ-NACE), which was taken into account in the final selection of the particular companies in a given district; the companies with the widest range of activities according to CZ-NACE were preferred.

The structure of the sample defines the group of respondents to whom the research was practically applied. Research conducted with a representative sample structure to the population structure has several advantages:

- The research results obtained with the sample structure have a comparable efficiency to the research results obtained with the population structure.
- Research conducted with a sample structure has a smaller number of respondents. Owing to this fact, it usually has a higher explanatory capacity (quality), as it reduces the risk of frequent reluctance to fill in a large number of questionnaires and at the same time reduces the risk of questionnaires being filled in by an incompetent person.

Owing to this approach, primary data was obtained with sufficient efficiency. This data was then statistically analysed to obtain the information and insights needed to solve the research aim.

2.3. Data analysis

In the data analysis, selected statistical methods, which fall into the area of categorical analysis, were used to identify dependencies between the two-dimensional data set of qualitative and quantitative variables. They were also used as the apparatus for statistical hypothesis testing for qualitative and quantitative variables.

The two-dimensional data set of qualitative variables represents the situation when the values are expressed in words. It is possible to simultaneously observe two or more qualitative responses, just as it is possible to measure or observe two or more random variables in an experiment. The results of the entire experiment can be summarized in the so-called contingency table. The alternative types (Yes, No) were considered in our research. Therefore, a special type of contingency table was used, the so-called 2x2 contingency table. The aim of the test of the independence of qualitative variables (chi-square test) is to determine whether the relevant two statistical variables are mutually dependent or not. If the dependence is confirmed by the test, the strength of this dependence is also sought. The strength of the dependence of the statistical variables can be determined using Cramer's contingency coefficient (Saigusa et al., 2015).

The two-dimensional data set of quantitative variables represents a data set with two random number values. The fact that two values are correlated indicates that certain values of one variable tend to occur together with certain values of the other variable. The degree of this tendency can range from a zero correlation (all values of one variable occur with the same probability together with each value of the other variable) to an absolute correlation (exactly one value of one variable occurs together with a given value of the other variable). The independence test of two quantitative attributes determines whether the random values *X* and *Y* are stochastically dependent, while the significance of the sample correlation coefficient to zero is tested. The null hypothesis is determined based on the general procedure of statistical hypothesis testing when the correlation coefficient is equal to zero, and the alternative hypothesis is determined when the correlation coefficient is not equal to zero (Field et al., 2012).

3. RESEARCH RESULTS

The relevant primary data obtained from the questionnaires was used as input data for the statistical testing of the defined statistical hypotheses. Hypothesis testing involved the process of identifying dependencies between qualitative variables.

3.1. Verification of Hypothesis H1

The alternative hypothesis H_1 and the null hypothesis H_0 were defined:

H_1: *There is a dependency between the level of using software support for project management and the ability to create the knowledge base for project management support.*

H_0: *There is no dependency between the level of using software support for project management and the ability to create the knowledge base for project management support.*

The qualitative variable "the level of using software support for project management" is denoted by the symbol A. The qualitative variable "the ability to create the knowledge base for project management support" is marked with the symbol B. The significance level is considered at the level of 0.05.

Table 3 shows the frequency of occurrence of the individual alternatives, the statistical variables "the level of using software support for project management" and " the ability to create the knowledge base for project management support".

In the framework of testing the independence of two qualitative variables, the null hypothesis H1 was tested, which describes the situation when statistical variables A and B are independent. Test results show that the test criterion (chikv = 21.567) is in the critical range. The null hypothesis is therefore rejected and

TABLE 3: Testing hypothesis H1 – 2x2 contingency table

	B1 (No)	B2 (Yes)	Marginal frequencies
A1 (No)	31	7	38
A2 (Yes)	0	9	9
Marginal frequencies	31	16	47

SOURCE: author's own processing

TABLE 4: Verification of Hypothesis H2– 2x2 contingency table

	B1 (No)	B2 (Yes)	Marginal frequencies
A1 (No)	32	6	38
A2 (Yes)	3	6	9
Marginal frequencies	35	12	47

SOURCE: author's own processing

the alternative hypothesis is accepted. It is possible to be mistaken in 5% of cases. In particular, the test results show that there is a dependency between the level of use of software support for project management and the ability to create the knowledge base to support project management. Based on Cramer's coefficient (V = 0.677), this dependency is rated as moderately strong.

3.2. Verification of Hypothesis H2

The alternative hypothesis H_1 and the null hypothesis H_0 were defined:

H_1: *There is a dependency between the level of using software support for project management and the project success.*

H_0: *There is no dependency between the level of using software support for project management and the project success.*

The qualitative variable "the level of using software support for project management" is denoted by the symbol A. The qualitative variable "the success of the project" is marked with the symbol B. The significance level is considered at the level of 0.05.

Table 4 presents the frequencies of occurrence of the individual alternatives, the statistical variables "the level of using software support for project management" and "the project success".

In the context of testing the independence of two qualitative variables, the null hypothesis H2 was tested, which describes the situation when the statistical variables A and B are independent. The test results show that the test criterion (chikv = 9.907) lies in the critical field. The null hypothesis is therefore rejected and the alternative hypothesis is accepted. It is possible to be wrong in 5% of cases. The test results specifically show that there is a dependency between the level of use of software support for project management and project success. Based on Cramer's coefficient (V = 0.459), this dependency is classified as medium.

The primary quantitative data used was used to identify in detail barriers to the creation of a knowledge base within Microsoft Project Applications. The potential dependencies were identified using the correlation coefficient in the correlation matrix. The results are presented in Table 5.

In all fields below the diagonal, the correlation coefficient is not equal to zero, which means that the respective statistical attributes are linearly dependent. At the same time, all correlation coefficient values are positive, i.e. these attributes are positively correlated. The values of the correlation coefficient have shown that there is a relatively strong linear dependency between the attributes "Project Baseline" and "Earned Value Analysis", "Effort-Driven Task" and "Project Baseline", "Effort-Driven Task" and "Earned Value Analysis", "Task Constraints" and "Specific Project Calendar", "Task Constraints" and "Effort-Driven Task", Constraints" and "Shared Resources". These dependencies are marked in Table 3. There is a medium correlation in the other fields. For the statistical attributes with stronger dependencies, the dependencies were further verified by a statistical test (see Table 6).

TABLE 5. Correlation matrix

	Task Constraints	Specific Project Calendar	Effort-Driven Task	Project Baseline	Earned Value Analysis	Shared Resources
Task Constraints	1					
Specific Project Calendar	0.6987	1				
Effort-driven Task	0.6250	0.5527	1			
Project Baseline	0.5018	0.5385	0.8358	1		
Earned Value Analysis	0.5264	0.5001	0.7570	0.8595	1	
Shared Resources	0.6062	0.4844	0.5620	0.4142	0.4912	1

SOURCE: author's own processing

TABLE 6. Independence test of the quantitative attributes

Attributes X Attributes Y	Test parameters					Test result			Conclusion
	Null hypothesis	Alternative hypothesis	Estimate ρ	Confidence interval for ρ	Level of significance a	Critical region		Critical value	
Project Baseline Earned Value Analysis	ρ = 0	ρ ≠ 0	0.8595	(0.760, 0.920)	0.05	2.014	-2.014	11.279	Rejection of the null hypothesis
Effort-driven Task Project Baseline	ρ = 0	ρ ≠ 0	0.8358	(0.722, 0.906)	0.05	2.014	-2.014	10.213	Rejection of the null hypothesis
Effort-driven Task Earned Value Analysis	ρ = 0	ρ ≠ 0	0.7570	(0.600, 0.858)	0.05	2.014	-2.014	7.773	Rejection of the null hypothesis
Task Constraints Specific Project Calendar	ρ = 0	ρ ≠ 0	0.6987	(0.515, 0.821)	0.05	2.014	-2.014	6.552	Rejection of the null hypothesis
Task Constraints Effort-driven Task	ρ = 0	ρ ≠ 0	0.6250	(0.412, 0.773)	0.05	2.014	-2.014	5.371	Rejection of the null hypothesis
Task Constraints Shared Resources	ρ = 0	ρ ≠ 0	0.6062	(0.386, 0.761)	0.05	2.014	-2.014	5.114	Rejection of the null hypothesis

SOURCE: author's own processing

The interpretations of the independence test of two quantitative attributes with significant linear dependencies are followers.

For the attributes "Project Baseline" and "Earned Value Analysis", the test indicates that the test criterion value was realized in the critical, region. Therefore, the null hypothesis is rejected at a significance level of 5%. According to the correlation coefficient, there is a positive correlation for the attributes "Project Baseline" and "Earned Value Analysis". A possible interpretation of this phenomenon is that if the respondents most frequently answered that they never use "Project Baseline", it is to be expected that they do not use "Earned Value Management" in the Microsoft Project application.

For the attributes "Effort-Driven Task" and "Project Baseline", the test indicates that the value of the test criterion was realized in the critical region. Therefore, the null hypothesis is rejected at a significance level of 5%. The attributes "Effort-Driven Task" and "Project Baseline" are correlated or positively correlated according to the correlation coefficient. A possible interpretation of this phenomenon is that if the respondents most frequently answered that they never use "Effort-Driven Task" or do not use it due to the nature of the project, it is to be expected that they do not use "Project Baseline" in the Microsoft Project application.

For the attributes "Effort-Driven task" and "Earned Value Analysis", the test indicates that the value of the test criterion was realized in the critical region. Therefore, the null hypothesis is rejected at a significance level of 5%. According to the correlation coefficient, the attributes "Effort-Driven Task" and "Earned Value Analysis" are correlated or positively correlated. A possible interpretation of this phenomenon is that if the respondents most frequently answered that they never use "Effort-Driven Task" because of the nature of the project, it is to be expected that they do not use "Earned Value Management" in the Microsoft Project application.

For the attributes "Task Constraints" and "Specific Project Calendar", the test shows that the value of the test criterion value is realized in the critical region Therefore, the null hypothesis is rejected at a significance level of 5%. The attributes "Task Constraints" and "Specific Project Calendar" are correlated or positively correlated according to the correlation coefficient. A possible interpretation of this phenomenon is that if the respondents answered most frequently that they never use the "Task Constraints" or do not use it due to the nature of the project, it is to be expected that they do not use "Specific Project Calendar" in the Microsoft Project application.

For the attributes "Task Constraints" and "Effort-Driven task" the test indicates that the value of the test criterion was realized in the critical region Therefore, the null hypothesis is rejected at a significance level of 5%. The attributes "Task Constraints" and "Effort-Driven Task" are correlated or positively correlated according to the correlation coefficient. A possible interpretation of this phenomenon is that if the respondents most frequently answered that they never use or do not use it due to the nature of the project "Task Constraints" it is to be expected that they do not use "Effort-Driven Task" in the Microsoft Project application.

For the attributes "Task Constraints" and "Shared Resources" the test indicates that the value of the test criterion was realized in the critical region Therefore, the null hypothesis is rejected at a significance level of 5%. The attributes "Task Constraints" and "Shared Resources" are correlated or positively correlated according to the correlation coefficient. A possible interpretation of this phenomenon is that if the respondents most frequently answered they never use "Task Constraints" or do not use it due to the nature of the project, it is to be expected that they do not use "Shared Resources" in the Microsoft Project application.

A cluster analysis was carried out to enable possible generalization of the results of the research carried out in the Vysočina region to other regions of the Czech Republic . The aim was to determine the level of "similarity" of the regions based on the data listed in Table 7. (Note: Since January 1, 2000, the Czech Republic has been divided into 13 regions (superordinate territorial self-government units) and 1 capital city (Prague) with regional status – see Table 7).

TABLE 7. Basic information on the entrepreneurship subjects in the Czech Republic

Region	Number of districts	Companies [number]
Prague	15	779
Central Bohemian	12	203
South Bohemian	7	127
Plzeň	7	132
Karlovy Vary	3	60
Ústí nad Labem	7	136
Liberec	4	153
Hradec Králové	5	161
Pardubice	4	205
Vysočina	5	117
South Moravian	7	415
Olomouc	5	179
Zlín	4	238
Moravian-Silesian	6	267

SOURCE: own processing based on (the Association of Innovative Entrepreneurship CR. (2021))

The results of the cluster analysis are presented in the Figure 1.

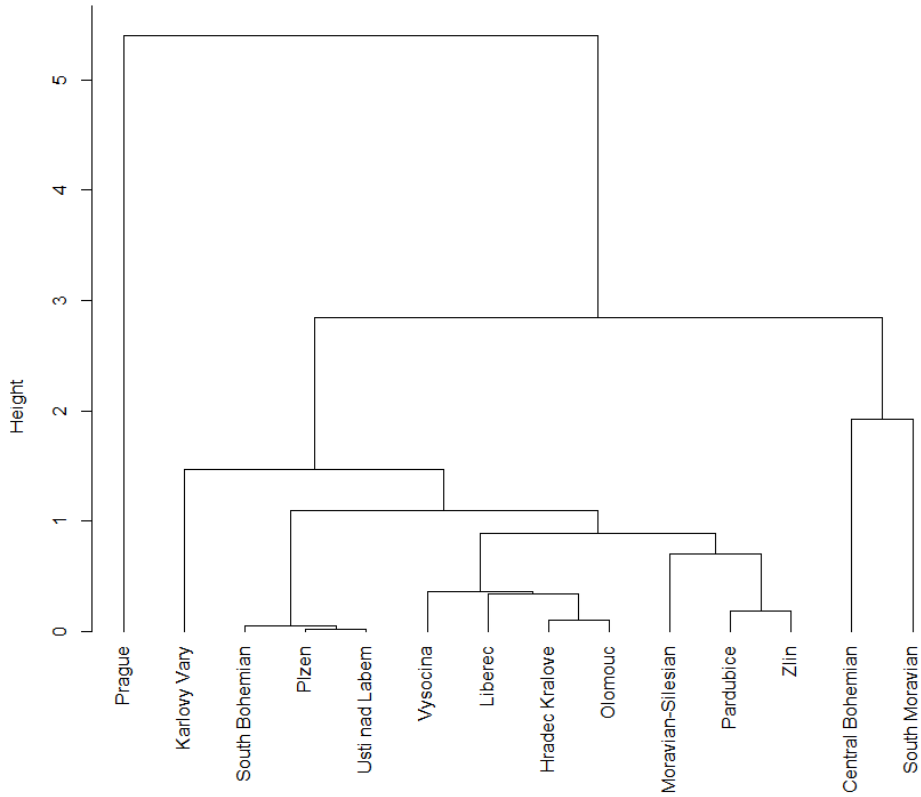

FIGURE 1. Cluster dendrogram
SOURCE: author's own processing

4. DISCUSSION

The identified level of use of the Microsoft Project application as a tool to support project management support defined the main barriers to the creation of a knowledge base. These barriers were categorised into three groups: significant, medium, and moderate, according to their impact on the project, especially in terms of insufficient centralization of data and information related to key project processes (time planning, resource allocation of, budget composition, project status evaluation, project risk management (Cooper et al., 2014; Trautmann & Brandinu, 2011; B. Zeng & Zhang, 2012).

4.1. Significant Barriers to the creation of a Knowledge Base in the Context of an MS Project

Significant barriers include situations where the functional knowledge base to support project management does not exist:

- **The MS Project application is used exclusively to project time analysis** – approximately 55% of the respondents stated that they use the MS Project application exclusively for project time planning. They use both modes of task scheduling (manual, automatic) as part of the task planning process. In general, they only use the standard duration, mostly often in days when scheduling tasks. Depending on the nature of the project, around 40% of respondents use both the standard duration and the elapsed duration**.**
- **The MS Project application is not used to analyse project resources and costs**– when planning project resources and costs, 10% of the respondents stated that they work solely with fixed costs or only with variable costs (taken the time factor into account). Special task calendars and resource calendars are not used in project practice by more than 50% of the respondents. The remaining 50% use special project calendars, occasionally depending on the nature of the project. Approximately 35% of the respondents stated that they do not handle assigned resources in the MS Project application. They are not aware of the automatic resource levelling function. Only two

respondents stated that they solve this problem by manual levelling.

- **The MS Project application is not used as a tool for project management using the project baseline in the project realization phase**– about 80% of the respondents do not use a project baseline within the MS Project application. The remaining 20% use the baseline on a regular basis.

The MS Project application is not used for evaluation of project status using the Earned Value Management (EVM) (Vanhoucke, 2014) – about 30% of the respondents use EVM in general or depending on the nature of the project. The remaining 70% of the respondents stated that they do not use this method.

4.2. Mediums Barriers to the Creation of a Knowledge Base in the Context of an MS Project

Medium barriers primarily include deficiencies that generally relate to incomplete or incorrect use of the application functionality.

- **Incomplete initial project settings –** all the respondents stated that they define the basic initial settings in the application. This setup refers to the definition of working and non-working hours and the definition of exceptions for working hours. About 70% of the respondents also set the project planning methodology in the application at the same time (ASAP, ALAP). Those who do not change this setting automatically plan the project in the ASAP mode, which may generally correspond to the practical project requirements. With regard to setting up the project calendar, it should be noted that it is necessary to adjust the default start time and the default end time of the calendar. Only 10% of respondents make this adjustment. The accuracy of the project calendar setup is crucial as it directly affects the processing of the project time analysis and thus the analysis of the project resources or costs later on.
- **Failure to use lag time and lead time for dependencies between tasks** – all the respondents stated that when defining dependencies between tasks, the dependency Finish-to-Start is used most frequently , followed by , the dependency Start-to-Start. This statement is fully consistent with common project practice. In this context, it should be noted that when defining dependencies between tasks, over 50% of the respondents never define the lead time or lag time for the respective dependency type. Approximately 35% of the respondents stated that they occasionally use the lead time or lag time, depending on the nature of the project. Only about 10% of the respondents stated that they use the lead time or lag time frequently.
- **Failure to use task constraint types –** approximately 50% of the respondents stated that they sometimes use certain task constraint types based on the nature of the project (FNET, FNLT, SNET, SNLT, MFO, MSO, etc.). The remaining part of the respondents, about 50%, stated that they never use these constraints. Only four respondents claimed that it is common for them to use certain task constraints in project planning.
- **Failure to use the function "Effort-Driven task" –** this function is not used by more than 50% of the respondents. The remaining 50% use it sometimes, depending on the project type. Only two respondents stated that they use this function frequently. It should be noted that the use of this function can influence the capacity of work resources among other things.

4.3. Moderate Barriers to the Creation of a Knowledge Base in the Context of an MS Project

Moderate barriers include mostly shortcomings that do not directly affect the assumed success of the project:

- **Failure to enter project metadata** – in addition, less than 50% of the respondents indicated that they enter metadata into the application, such as project title, project topic, project manager, etc. The lack of such metadata can have a negative impact on project management as a whole or on the sharing of project data. These data are missing in project reports, for example. The generated data sets are therefore "nameless".
- **Failure to use shared project resources** – shared resources are used in the MS Project application by approximately 30% of the respondents. The remaining respondents stated that they do not use shared resources in MS Projects at all or they address this problem using an external application, usually MS Excel. Those who work with shared resources in Microsoft Project do so via the MS Project Server. None of the respondents mentioned the use of the tool *Resource Pool*. Nevertheless, the *Resource Pool* facilitates work with shared resources to a certain extent, even without an MS Project Server connection. In certain project situations, this may be a sufficient solution to the problem of shared resources. It is also cheaper compared to the financial requirements of purchasing a project server.
- **Failure to use custom reports** – a project reporting is realized by about 65% of the respondents using predefined reports in the Microsoft Project application. The remaining part of the respondents, about 35%, stated that they use custom reports in addition to the predefined reports.

4.4. Suggestions for the Use of MS Project as a Suitable Knowledge Base

Microsoft Project application can be used as a suitable form of knowledge base to support project planning and management. However, an essential prerequisite is the effort to fully utilize the potential it offers the user. The knowledge base in Microsoft Projects must incorporate information concerning time, resource, and cost analysis of the project as well as additional project-related information. When analyzing the time of the project, it is important to also consider the elapsed duration, especially in situations where the tasks can also be performed on non-project days and usually without resource allocation. In this way, greater accuracy of the project schedule is achieved. When analyzing the project's resources and costs, it is important to work with shared resources across the entire project portfolio. This is common in today's project practice. Next, it is important to understand the scheduling formula in MS Project. It refers to three values of work duration and allocation units: Work = Duration · Units. This makes the allocation of labour resources most complicated, although strictly speaking the technical allocation procedure is the same as for the allocation of material and cost resources. To clarify which value in the formula may be changed and which must be constant, one should define the task type, fixed duration, fixed units, and fixed labour. Next, it is advisable to manually level the allocated resources. This approach is more professional and primarily uses the knowledge gained from the project time analysis. The allocated resources may be levelled more precisely within the additional time allocated to the tasks. This form of levelling is usually more time-consuming but also more efficient when compared to automatic levelling.

Additional information is primarily information that arises through the process of externalizing knowledge. Details on this can be found in the SECI model (Begnini, 2015). The knowledge base is therefore expanded to include information that usually originates in the tacit knowledge form. In Microsoft Project, this primarily involves adding further information, e.g., to project resources or tasks in the form of notes. In this way, specific information on a given person can be added to the application, including photos and uploaded CV, etc. Other types of additional information may be entered into Microsoft Project, e.g., in the form of a hyperlink.

The application is able to generate, collect, store and print a range of various data, information, and knowledge on the project using different customer displays and reports. These outputs may be shared with other stakeholders. The arrangement depends not only on the type of a display selected, but also on the method used to filter, group or sort data. In this way, the knowledge base becomes more extensive and enables a relatively fast and easy access to the knowledge required for project management by a particular project stakeholder. This enables efficient reactions to inevitable changes that occur within projects during their execution. At the same time, these projects can be shared with other groups of project stakeholders and kept for further use.

5. CONCLUSION

The paper contributes to the development of the so-called integrated management. It does so by integrating knowledge management into project management. The need to manage knowledge in projects is documented by the fact that a new process "Manage Project Knowledge" has already been added to the PMBOK® Guide 6th Edition. The existence of a high-quality knowledge base in the field of project management is a fundamental building block for the implementation of knowledge management principles in project management.

The main contribution and novelty of the paper is the identification of barriers to the creation of a knowledge base in the context of Microsoft Project Applications during the project life cycle (pre-project, planning, implementation, and post-project phases). The identified barriers were classified into three levels (significant, medium and moderate). These levels can be used by the managers of the company as the priorities in the process of reducing barriers. The target state should be the complete elimination of the barriers. The classification of the barriers was based on the impact on the project, especially with regard to the lack of centralization of data, information and knowledge related to the key project processes (time planning, resource allocation, budget composition, project status assessment and project risk management) – perspectives. The central representation of knowledge from the above-mentioned perspectives (e.g. in the form of a Microsoft Project) is a prerequisite for the creation of a knowledge base in the field of project management.

Such a knowledge base provides the knowledge needed for advanced project management. In particular, for the realization of project predictions and eventually the construction of expert/knowledge systems to support project predictions (Govindarajan, 2015; Liu et al., 2006; Woolliscroft et al., 2013). This can be the topic of next research. The area of project prediction is not yet well understood, but it is very important for successful project management today.

The need for project forecasting has been emphasized at many project management conferences. The rules in the latest version of the PMBOK (Project Management Institute, 2021) and the ICB (IPMA, 2015) require project reporting to include only the current status of the project, but also its forecast. Project forecasting models must be proposed and implemented at least in relation to the future development of project time, resources and costs. Failure to meet the planned project duration or exceeding the project budget are still common reasons for project failure.

As a limitation of the research, it should be noted that the conclusions are interpreted only for the Vysočina region. Their generalization to other regions of the Czech Republic was tested using a cluster analysis. The conclusions of the cluster analysis (see Figure 1) show that the results of the research conducted in the Vysočina region can only be generalized to the Liberec, Hradec Králové and Olomouc regions, at a level of approximately 0.4 (distance of points in space), and to a lesser extent to the Moravian-Silesian, Pardubice, Zlín regions, etc. It follows that the conclusions of the research should be considered exploratory, which creates hypotheses for further research.

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PREPREKE U STVARANJU BAZE ZNANJA U KONTEKSTU PRIMJENE MICROSOFT PROJECTA APLIKACIJE

SAŽETAK

Rad prikazuje rezultate empirijskog istraživanja usmjerenog na utvrđivanje razine praktične primjene aplikacije Microsoft (MS) Project kao prikladne baze znanja za podršku upravljanju projektima. Glavni cilj istraživanja je identificirati prepreke u stvaranju baze znanja u kontekstu korištenja aplikacije Microsoft Project. U svrhu ostvarivanja cilja rada provedeno je anketno ispitivanje u obliku vođenog intervjua, a formulirane su dvije statističke hipoteze (H1, H2). Istraživanje je provedeno u odabranoj regiji u Češkoj Republici, koristeći uzorak koji je reprezentativan za strukturu populacije. Rezultati istraživanja potvrđuju postojanje prepreka pri stvaranju baze znanja u kontekstu korištenja Microsoft Projecta. Te su prepreke kategorizirane u tri skupine: značajne, srednje i umjerene. Klasifikacija se prvenstveno temelji na nedostatnoj centralizaciji podataka, informacija i znanja vezanih uz ključne projektne procese (planiranje vremena, alokaciju resursa, izradu budžeta, evaluaciju statusa projekta i upravljanje rizicima projekta).

Najvažnije prepreke uključuju: aplikacija MS Project koristi se u fazi planiranja projekta isključivo za analizu vremena (a ne i za analizu resursa i troškova); aplikacija se ne koristi u fazi realizacije projekta (nedostatak osnovne projektne dokumentacije, izostanak evaluacije statusa projekta). Srednje prepreke uključuju: nepotpuno početno postavljanje projekta; neprimjena vremenskog odmaka i preklapanja između zadataka; neupotreba tipova ograničenja zadataka; neupotreba funkcije „Zadatak ovisan o trudu“ (Effort-Driven Task). Umjerene prepreke uključuju: neunošenje metapodataka projekta; neupotreba zajedničkih resursa projekta; neupotreba prilagođenih izvješća.

KLJUČNE RIJEČI: *Microsoft Project, upravljanje projektima, baze znanja, prepreke, analiza korištenja.*