




Article

Design of a Model for Risk Reduction in Project Management in Small and Medium-Sized Enterprises

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Abstract: In general, it can be said that a project is a means of change so that the organization or individual obtain something they do not currently have, and which, in some respects, can ensure its functioning within the system in society, in the market, etc. Organizations often use different tools and techniques in project implementation to help manage projects. The selection of the optimal method requires a thorough systematic analysis. The chosen method must cover the requirements of project management with regard to its size and nature. One such tool is the ISO 21500 Guidance on project management standard, which defines the basic processes and documents needed for project management. The aim of this article is to propose a model through which it would be possible to effectively manage projects in small and medium enterprises (SMEs), i.e., where generally available international methodologies for project management are not introduced. The proposed model (referred to as Model B) was verified on projects in different SMEs in Slovakia. Mathematical evaluation presented in the paper as well as the knowledge and experience from this verification were summarized and the proposed Model B was modified (referred to as SMEPM: small and medium enterprises project management) so that it can be used in the implementation of other projects in the conditions of SMEs.

Keywords: project management; triple imperative; risk; small- and medium-sized enterprises (SMEs)



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1. Introduction

Project management has been constantly evolving since its beginnings in the 1920s. The experience and availability of various techniques give space for the development of new models and management approaches. Software applications can coordinate the time and financial management of the project, delay but also reserves through their programmed procedures. All this requires the integration of various project techniques using symmetry of information, communication, risk management, change tracking, maintaining quality in a dynamic environment such as time. The roots of project management can be found in the distant past in the implementation of large-scale actions containing elements of projects, but unlike current projects, time and resources were not limiting factors [1]. In the 1970s, organizations began to appear that, with their standards, began to methodically cover the field of project management. The use of project management also began to move towards a simpler business environment. The critical path method (CPM) became a suitable tool to support project management [2,3], while network analysis and the first Gantt charts [4] also became known. For the first time in the late 1960s, the program evaluation and review technique (PERT) evaluation and control technique was used [1]. The turning point of project management can be considered the 1980s, when the first software to support project management began to emerge with the development of computers [5]. In the last 40 years, project management has been a routine component in many industries, from the military

through the pharmaceutical and chemical industries, advertising, law, IT, etc. [6]. The worldwide Project Management Institute (PMI) [7], which publishes the internationally recognized Project Management Body of Knowledge (PMBOK) standard, defines project management as the application of knowledge, skills, tools, and techniques to project activities so that the project meets its requirements [3,7,8]. On the other hand, it must be emphasized that, even if a project is managed, the results may not be successful [9]. An anonymous survey from 2007 states that project failure depends on 43% of communication within the project team [10,11]. Mutual communication must be set up so that any deviation from the plan does not interfere with the goal set at the beginning. The implementation of a project is always a tool for change, and its management is different depending on the length but also the nature of the implemented activities. Today, projects are considered a common part of life, where they also address educational processes [12] and research activities [13]. Their existence has a place in almost every major company, and their management requires a specific approach, which must be consistent with the approach to the management of the entire organization. There are many one-off actions in companies in the form of projects that are often part of strategic management [14,15]. Since the beginning of the first projects, which took place in the past for several years and had a budget at the level of hundreds of thousands to millions (construction of roads, hospitals, schools, etc.), today, the project is also understood as much smaller activities. However, the principle must be that the output of the project is unique. If new activities are implemented in the organization, the goal of which is the same as in the previous project, it does not mean that it is a new project. It is just a repeated activity. A typical example is the production processes in an automotive organization [3,16], the aim of which is to produce the required number of cars of the same type based on selected inputs and production processes. This process is repeated periodically with the same inputs, settings, and outputs, i.e., it does not meet the main features of the project [16]. However, if a manufacturer decides to innovate its production process with new technological solutions, the aim of which is to bring more efficient implementation of the whole process combined with profit maximization, reduction of environmental impact, support research and development in the field, it is possible to talk about an idea or initiative so that it can be gradually transformed into a project [17,18]. Such types of projects are now a common part of production facilities, and in practice, they can be encountered as part of Six Sigma or "lean production" concepts [3,19,20].

In an advanced organization, the requirement for change is a common part of managerial management and improvement [21] in project implementation, but change may not always be perceived as acceptable [22]. If the project is planned in detail, its implementation is expected to be in line with the plan. However, such an idea is unrealistic as project management also includes operation and additional acceptance of change [23]. If these changes are reflected in the project positively, they become an added value, but if they are negative, it will affect not only other activities but also the entire result of the project. The implementation of processes and the implementation of changes should, therefore, take place in such a way that the final evaluation of the project does not become the biggest problem of the whole project [24].

The number of employees or the size of the company is an aspect that affects the overall management of the organization and the implementation of processes. While large enterprises implement projects systematically using various software applications, SMEs tend to pursue operational activities in project management that are less bureaucratic and easier to control [25]. In Europe, SMEs are considered to meet the classification criteria set by the Recommendation of the European Commission no. 2003/361/EC of 1 January 2005, as follows: a small enterprise is one that employs less than 50 people and has an annual turnover of less than 10 million EUR, and a medium one employs less than 250 people and has a turnover of up to 50 million EUR [17,19,26]. According to Turner et al. [1,27], in small enterprises, simple planning, as well as informal evaluation, is preferred, while implementation does not use standard procedures but rather an operation based on rapid

decision-making. Such a way of management represents more freedom but increases the risk of wrong decisions caused, e.g., by the insufficient experience of the project manager.

SMEs in Slovakia represent 99.9% of the total number of business entities, providing employment opportunities to almost three quarters (74%) of the active workforce in the corporate economy and contributing by more than half (55%) to value added. Ninety-seven percent of SMEs are micro-enterprises employing less than 10 employees. More than three quarters of SMEs are active in sectors such as business services, trade, construction, and industry. SMEs recorded a positive development in 2019, but their results have already been affected by the slowdown in the growth rate of the Slovak economy, which has achieved the lowest growth in the last three years. The year 2019 was also the last year of a successful decade for small- and medium-sized enterprises, which was characterized by an increase in the performance of the SME sector. The current pandemic situation, caused by the spread of the COVID-19 virus, has been directly affecting the SME economy in Slovakia since March 2020, and its consequences are currently having a huge negative impact. As a result of this crisis, the risk of inability to meet their obligations has begun to increase as SMEs are largely focused on the domestic market. A government program aimed at minimizing the effects of this crisis is being implemented in Slovakia, but delays in reimbursing payments and the actual implementation of rescue measures are forcing these organizations to look for other financing alternatives. One of them is the implementation of projects financed from EU funds. In 2020, more than 330 million euros were transferred to Slovakia to support small- and medium-sized enterprises. Most of these organizations have not yet had experience with the implementation of such projects, and for this reason, the model we have proposed could contribute to their easier implementation.

As project management in SMEs does not fall under a separate project department composed of several experts, it is important that delegated project managers are able to manage project processes without unnecessary procedures and bureaucratic steps. Especially, when people do not have enough experience, it is necessary to provide them model or guide, which will help them to perform all the project management processes with the symmetry. The proposed SMEPM methodology is based on the requirements of SMEs to create such a tool to support project management so that the whole process is efficient, easy to assess, and reduces the risk of errors and negative impacts on the set objectives, which should help to manage the project phases symmetrically. According to results, our model was proved to be well-applicable in SMEs using symmetric approach in project management.

2. Literature Review

The basic, but at the same time very simplified, platform for project management is the monitoring of three basic elements, also called the project triple imperative [27], and which are often associated with the success of the project. The project triple imperative is the expression of three basic parameters that measure the success of the project, i.e., time, project budget, and quality of output.

In general, there is no unified definition for project management. Nevertheless, most traditional definitions include a reference to achieving unique goal objectives while using optimal costs and within a certain time [28,29]. In other words, it is the implementation of activities to increase the effectiveness of selected activities [28,30] due to the achieved goals. The use of project management, as well as its specific methodologies and tools, is described in several selected studies [28,31–34]. One of the first [31] referred to a questionnaire examining the use of known PM methods and techniques. The result was a list of the 44 most common tools where the authors found that the most used tools identified were “off the shelf” software (77% of the respondents), Gantt charts (64%), and cost-benefit analysis (37%). This study was later followed by [32], which summarized the 70 most used tools and techniques, dividing them into individual branches [28,32]. Many of these studies referred to the use of project management tools and techniques in large organizations, but small- and medium-sized enterprises require different techniques and tools. In their paper, [32]

describe research into the use of project management tools and techniques in small- and medium-sized enterprises [35,36]. This research is later referred to in the contribution by [37], which points out not only the differences based on the size of the company but also on the length of existence of the organization itself. It focuses on the so-called start-ups, where the existence of the organization itself is still at the beginning, and an inappropriately chosen method of project implementation can have a fatal consequence. On the contrary, a suitably chosen method of project management in SMEs can ensure the success of the organization itself [37,38].

In practice, project management usually brings various complications, and this also applies to the best planned ones. The schedule is most often delayed (time), costs are exceeded (project budget), and sometimes the quality of output deteriorates when trying to meet these two parameters. Each of these situations is bad for the customer. Late delivered project output, although of good quality and at the original price, can cause the same problems as poor-quality output even though it is delivered on time [27,39].

The triple imperative is sometimes called a three-dimensional goal that links minimum time, minimum cost, and maximum results [2,27]. It can also denote the relationship of three dimensions, namely, the allowable duration, cost, and specification (quality) of the goal [12,14]. Several literature sources [2,15,27,40] agree that these characteristics or limiting factors must be measurable (i.e., real, and verifiable) and achievable and must be seen as a whole as any change in one has an impact on the other two, and therefore, it is desirable to always keep this dynamic system in balance, which should be guaranteed by the project plan. Keeping the project's triple imperative in balance is, therefore, the greatest skill of quality project managers. There is no clear rule to achieve this. It is mainly about the experience; the correct estimation of the situation within the project; and the prevention of situations that ruin the schedule, budget, or quality. It is not enough to monitor these three variables when managing a project. The management also includes other parameters, such as, e.g., risks, environment, people, available techniques, and often also legislation or changes in customer requirements. The globally recognized PRINCE 2 methodology [41] states that project management is the planning, delegation, monitoring, and control of all aspects and motivations of all involved to achieve project objectives within the expected time, quality, scope, price, benefits, and risks [41–43].

Today, there are many tools, i.e., project methodologies or standards that incorporate best practices, or directly, a "TO DO LIST", and can help and prevent problems during the project from the initial phase to the end. Each of these methodologies is (despite their limitations) a tool to reduce the risk of incorrect project management [44]. Inappropriate risk management or its underestimation can affect the basic requirements of project management in terms of time or finances, as well as results. There are several generally accepted methodologies for project management; the most common of which are [3,43]:

- PMBOK. It is a methodology published by the world's largest project management association, the Project Management Institute (PMI) [8]. Currently, the sixth version of this methodology is available, which was created based on "best practices" collected from several project managers and was strongly process-oriented. It deals with commercially important aspects, such as, e.g., public procurement, quality management, and human resources development. In the beginning, it was most used in the USA, but today, it can also be found in international corporations. It is currently often used as a basis for project management information for most publications in this field [3].
- Projects IN Controlled Environments (PRINCE2). It is a methodology for project management that comes from the environment of public administration. Based on this methodology, the project is approached as a logical sequence of well-defined steps, in which, however, it is possible to make the necessary changes during its implementation. It is used mainly where it is necessary to research external suppliers of selected processes in the project. However, it is disadvantageous for small projects as its complex structure can be a burden for them, and at the same time, regular and strict control can complicate normal project activities [41,42].

- Individual competence baseline (ICB). These are procedures issued by the International Project Management Association (IPMA), and they are an international standard of project management competencies, i.e., project leader and project team. They do not contain a description of the processes or methodology according to which the project should be managed, but they provide a set of characteristics that the project manager should meet [5,11].
- Managing Successful Programs (MSP). It is a program-oriented methodology that differs from the project in the way of understanding the achieved result. While the goal of the project is some result, the goal of the program is some consequence—a response to change, a benefit for the organization [3].
- The ISO 21500 standard. It follows the ISO 10006 standard and takes the form of a project management guide. It provides a description of concepts and processes that represent good practice in project management to which the principles of the quality management system should be applied. It can be used for any type of project, regardless of its complexity, scope, or duration. It provides a more comprehensive approach to project management as it is based not only on the PMBOK standard (90% of processes have the same name) but also on IPMA (all technical competencies are covered; 50% of behavioural and most contextual competencies are shared). There is also a particularly good match with PRINCE2 processes and topics. The names are different but refer to the same activities [1].

Various software applications that use a range of statistical techniques and tools have an exceptional position in their management or monitoring. Their use in the project is not about management but rather about monitoring, and thus, they contribute to the decisions that management makes. The logical frame method and the management by objectives (MBO) technique are often used when starting a project [45]. The basic tool for project planning and management is network analysis [46,47], namely critical path method (CPM), program evaluation and review technique (PERT), metra potential method (MPM), and GERT. Recently, the critical chain (CC) method, based on the theory of constraints, has been promoted [1,48]. Network analysis methods are used to harmonize the timing of different, interdependent activities in the management of large projects. Network analysis is part of operational analysis [49] and is focused on the construction, solution, and application of mathematical models of complex clusters of activities. The network graph shows the connections and dependencies of project activities or tasks in the graphical form [12,50]. Popular Gantt charts are used in the design but mainly to present the time course of project activities [4,51]. To identify potential obstacles to the success of the project, selected procedures for risk analysis (risk engineering) are applied, e.g., risk project analysis (RIPRAN) [52], the critical success factor analysis (CSFA) method, and the Ishikawa diagram technique [53] are applied to support project success. Various modifications of value analysis and cost controlling are used to reduce project costs [43]. Various forms of walkthroughs, methods of group problem solving (brainstorming, Delphi, Occam's Razor) are used to successfully manage teamwork [54–56]. The list of these tools is not and cannot be exhaustive, as project teams use a range of special methods to solve specific problems. In addition to the basic methods of project management, of course, several other methods of system and operational analysis are used: methods to support decision-making, process modelling, computer simulation of the project, software support such as MS Project or computer in project (CIP), etc. [39,57,58].

Which methodology the organization chooses depends on the size of the project, its nature, and the number of people involved but also the internal standards in the organization itself.

In addition to a systematic approach, project management also requires sufficient experience and knowledge in this area. As mentioned, in small- and medium-sized enterprises, project management is often carried out operationally as this type of enterprise does not have a separate department that plans and later implements projects. Based on this, it is likely that they do not even have a methodology that would help them in the

implementation of projects. Our effort was to prepare a model that will be used in these types of companies as a “standard” for their implementation and that, in the future, a handbook could be created that could methodically guide project management. Our goal was to describe the processes in all three organizations that are necessary and must be implemented but also to eliminate those that seem to be redundant for a smaller type of organization or are not feasible. In his study, Tereso et al. [28] states that “Good practice does not mean that the knowledge described should always be applied uniformly to all projects.” Therefore, our effort was to create a model that would be sufficiently standardized but also flexible for further possible use.

The management of each project requires thorough coordination from the first point when the idea for the preparation of the project falls to the delivery of its result. Despite the activities planned in detail, one of the most important points of any project is to monitor but also to manage the risks that may affect the actual implementation of the project. Risk management of each project helps to identify, minimize, or even completely remove obstacles that, without proper and timely identification, could cause large time and financial losses or jeopardize and stop the project. Many of the risks of the project are very “well hidden” and arise just when they are least expected. The way or method of risk management is directly dependent on the complexity of the project and its outcome [59].

Risk management, as it applies to projects, was first documented in the 1970s [56,60]. Two decades ago, [61] acknowledged that the traditional practice of project risk is negative, characterizing risks as threats that come with adverse consequences on an organization’s objectives. Risk management can also focus on positive risk (or opportunity) management, which is used to identify potential benefits to the current project [62,63] At least in the project management literature, risk has evolved from one that focused on the likelihood of a negative outcome to an assessment of both negative and positive outcomes.

According to [64,65], risk management should be applied at the project portfolio level. The ISO 21500 standard deals with risks in several process groups, but most of the implemented projects in SMEs remain in the identification of project risks only based on SWOT analysis.

According to the literature review, there are research gaps about using models based on ISO21500 in small and medium enterprises that can be modified for the individual projects. Companies use different agile approaches to finish projects and provide deliverables, but there is no specific guide based on the ISO 21500 model that can be generally used.

3. Material and Methods

In carrying out our research, we wanted to use a general model that would describe the individual steps of the project life cycle but also be able to cover the project management processes. For this reason, we were inspired by the model mentioned in the ISO 21500 standard, which we readjusted to the questionnaire to create model B. The major benefits of this standard were timely project execution, well-defined processes and activities, higher productivity, lower execution costs, and lower risk from failure [66,67]. The provided questionnaire contained already modified process groups of the ISO 21500 standard. Subsequently, the organization was selected, and the date of the meeting was specified. Our goal was to get information directly from those who came into close contact with the project. In two organizations, two people directly from the management also appeared among the respondents. The acquisition of information was based not only on quantitative scoring but also on personal interviews, due to which we had space to explain the individual areas in detail and record the answers. Based on the information obtained, we created the final SMEPM model, which included feedback from respondents.

4. Design of a Model for Project Management

The presented design of the model for SMEPM project management is based on the ISO 21500 standard, which describes the requirements for individual phases or project management processes. In multinational companies, projects are implemented in long-term

time horizons with a precise routine and approval process, where they are coordinated in a controlled manner by the selected organizational unit and existing proven methods or software products.

In small- and medium-sized enterprises, projects are mostly managed by selected people who have a different position, and often the projects themselves are a one-shot activity for them rather than a regular work activity. It is for this reason that it has been possible to create a functional model that, due to its universality, can be used in any project and, at the same time, will not be a limiting element that would unnecessarily bureaucratize the implementation of the project. The algorithm for the implementation of individual processes was based on the fact that all 39 steps/activities within the processes would be implemented in the organization (marked as 4.3.2–4.3.40 [10,68]). The proposed SMEPM model is based on the original ISO 21500 model (referred to as Model A) and considers the five basic phases of the project life cycle—see Figure 1.

Subject groups	Process groups				
	INITIATING	PLANNING	IMPLEMENTING	CONTROLLING	CLOSING
Integration	4.3.2 Develop project charter	4.3.3 Develop project plans: primary inputs and outputs	4.3.4 Direct project work	4.3.5 Control project work: primary inputs and outputs 4.3.6 Control changes	4.3.7 Close of project phase or project 4.3.8 Collect lessons learned
Stakeholder	4.3.9 Identify stakeholders		4.3.10 Manage stakeholders		
Scope		4.3.11 Define scope 4.3.12 Create work breakdown structure 4.3.13 Define activities		4.3.14 Control scope	
Resource	4.3.15 Establish project team	4.3.16 Estimate resources 4.3.17 Define project organization	4.3.18 Develop project team	4.3.19 Control resources 4.3.20 Manage project team	
Time		4.3.21 Sequence activities 4.3.22 Estimate activity duration 4.3.23 Develop schedule		4.3.24 Control schedule	
Cost		4.3.25 Estimate costs 4.3.26 Develop budget		4.3.27 Control costs	
Risk		4.3.28 Identify risks 4.3.29 Assess risks	4.3.30 Treat risks	4.3.31 Control risks	
Quality		4.3.32 Plan quality	4.3.33 Perform quality assurance	4.3.34 Perform quality control	
Procurement		4.3.35 Plan procurements	4.3.36 Select suppliers	4.3.37 Administer procurements	
Communication		4.3.38 Plan communication	4.3.39 Distribute information	4.3.40 Manage communications	

Figure 1. Model A—Sequence of process implementation [10,68].

When creating the SMEPM model, we merged content-like groups of processes from Model A so that there was no loss of implemented activities and, at the same time, selected activities were added, such as communication, monitoring, change management, etc. This created 27 separate process groups called Model B—see Figure 2—which we used in the verification.

Case Study of the Use of a Model for Project Management in SMEs

The verification of Model B was carried out in three independent organizations as it was mainly to verify the suitability of the model for project management. All three organizations fell into groups of small- and medium-sized enterprises and offered the production of products and specific services. Organization 1 was an independent research and development center of the Faculty of Mechanical Engineering of the Technical University of Košice (TUKE), which deals with the production and testing of prototypes, machines, and equipment, as well as small series production and various innovations of production. At present, they are partners of the project within the HORIZON 2020

program; they have experience with the implementation of smaller national projects as well as projects within the structural funds. Organization 2 was engaged in the production of custom-made implants from titanium using 3D printing technology, the production of parts and prototypes from plastic and metal using 3D printing technology, science and research in the field of implantology, and the production of implants. Due to the subject of business, the organization has experience in solving international projects within the HORIZON 2020 program but also within smaller transnational programs, where it acts as a partner as well as the grant applicant itself. Organization 3 was dedicated to the production of products as well as the provision of services. It currently provides services in the field of thermography, sensorics, medical technology, and 3D printing but also project management. The employees of the organization have experience with national projects, especially from the framework of structural funds.

	Process groups				
Subject groups	INITIATING	PLANNING	IMPLEMENTING	CONTROLLING	CLOSING
Integration	4.3.2 Develop project charter 1	4.3.3 Develop project plans: primary inputs and outputs 4	4.3.4 Direct project work	4.3.5 Control project work: primary inputs and outputs 4.3.6 Control changes	4.3.7 Close of project phase or project 4.3.8 Collect lessons learned 26
Stakeholder	4.3.9 Identify stakeholders 2		4.3.10 Manage stakeholders 13		
Scope		4.3.11 Define scope 4.3.12 Create work breakdown structure 4.3.13 Define activities 5 6		4.3.14 Control scope 18	
Resource	4.3.15 Establish project team 3	4.3.16 Estimate resources 4.3.17 Define project organization 7	4.3.18 Develop project team 14	4.3.19 Control resources 4.3.20 Manage project team 19 20	
Time		4.3.21 Sequence activities 4.3.22 Estimate activity duration 4.3.23 Develop schedule 8		4.3.24 Control Schedule 21	
Cost		4.3.25 Estimate costs 4.3.26 Develop budget 9		4.3.27 Control costs 22	
Risk		4.3.28 Identify risks 4.3.29 Assess risks 10	4.3.30 Treat risks Added: Analyze, Evaluate risks 15	4.3.31 Control Treat risks 23	
Quality		4.3.32 Plan quality Added: control, communication, changes 11	4.3.33 Perform quality Assurance Added: project control, communication, changes, monitoring 16	4.3.34 Perform quality control Added: project control, communication, changes, monitoring 24	
Procurement		4.3.35 Plan procurements 12	4.3.36 Select suppliers 17	4.3.37 Administer procurements 25	
Communication		4.3.38 Plan communication	4.3.39 Distribute information	4.3.40 Manage communications	

Figure 2. Model B—Model of processes for project management. Source: own research.

Model B (Figure 2) was presented in all three organizations, while the management of each organization selected an exemplary project on which the model was verified. All selected exemplary projects fell under the scheme of national projects. The suitability and chronological sequence of the 27 Model B processes were examined in detail. In each organization, a questionnaire was submitted to three persons, designated as E1, E2, E3 (employee 1,2,3), which contained a detailed description of the process groups, necessary inputs, and outputs. Respondents directly participated in selected projects, both in the planning phase and in the implementation itself. Each of the selected respondents had to assess the suitability, application, and importance of the process group in the implementation of their project and evaluate the content and location of the process group with one of three responses. If the respondent considered the content of the procedural group to be appropriate but its chronological location was not, the question was rated 2. If the respondent stated that the procedural group had no meaning, the question was rated 1—see Table 1.

Table 1. Example of evaluating the importance of process groups. Source: own research.

Value	Explanation
1	I do not agree with the content or placement.
2	I agree with the content but not with the location; a modification is required.
3	I agree with both the content and the location.

The final evaluation of the process group was calculated by the answers of individual respondents according to the relationship—see Table 2:

$$V_{PG} = \sum_{k=1}^n V_{PGn} = \sum V_{PG1} + \sum V_{PG2} + \sum V_{PG3} \quad (1)$$

where:

V_{PG} is the total value (sum) of the answers of all respondents,

V_{PG1} are the values of the answers of the respondents of the organization 1,

V_{PG2} are the values of the answers of the respondents of the organization 2,

V_{PG3} are the values of the answers of the respondents of the organization 3.

Table 2. Evaluation of process groups. Source: own research.

ProcessGroups	V_{PG1}			V_{PG2}			V_{PG3}			SUM	SUM	SUM	SUM	%
	E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3	V_{PG1}	V_{PG2}	V_{PG3}	V_{PG}	
1 Develop project charter	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
2 Identify stakeholders	2	1	1	3	3	3	2	2	2	4.00	9.00	6.00	19	70%
3 Establish project team	2	3	3	3	3	3	2	3	3	8.00	9.00	8.00	25	93%
4 Develop project plans: primary inputs and outputs	2	2	1	3	2	1	3	1	1	5.00	6.00	5.00	16	59%
5 Defines cope	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
6 Create work-breakdown structure	2	3	3	3	3	3	2	2	2	8.00	9.00	6.00	23	85%
7 Estimate resources	3	2	2	3	2	2	3	2	2	7.00	7.00	7.00	21	78%
8 Develop schedule	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
9 Develop budget	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
10 Identify risks	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
11 Plan quality	2	2	2	3	1	1	2	1	2	6.00	5.00	5.00	16	59%
12 Plan procurement	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
13 Manage stakeholders	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
14 Develop project team	3	2	3	3	3	3	3	3	3	8.00	9.00	9.00	26	96%
15 Analyze, evaluate risks	3	3	3	3	2	1	2	2	1	9.00	6.00	5.00	20	74%
16 Perform quality assurance	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
17 Select suppliers	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
18 Control scope	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
19 Control resources	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
20 Manage project team	3	2	3	3	3	3	3	2	3	8.00	9.00	8.00	25	93%
21 Control schedule	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
22 Control costs	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
23 Treat risks	3	2	2	3	3	3	3	3	2	7.00	9.00	8.00	24	89%
24 Perform quality control	3	2	2	3	2	2	3	3	3	7.00	7.00	9.00	23	85%
25 Administer procurements	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
26 Close of project phase or project	3	3	3	3	3	3	3	3	3	9.00	9.00	9.00	27	100%
27 Collect lessons learned	2	1	2	2	2	1	2	2	1	5.00	5.00	5.00	15	56%

The value of V_{PGn} was also expressed as a percentage with three evaluated areas, namely: 4 Develop project plans, primary inputs and outputs; 11 Plan quality; and 27 Col-

lect lessons learned showed less than 60% in the overall percentage evaluation. This means that these three areas were perceived by the respondents as insignificant in solving projects. At the same time, a folded bar graph was created for comparison—see Figure 3—which reflected the summary responses of individual organizations. Process groups that reached a value less than 16 or reached less than 60% were the subject of further discussion and became the basis for a qualitative evaluation of the use of Model B.

Project management also brings its own company know-how, which was also the content of our survey. The primary goal was to find several organizations from different sectors and try to interview more than three people. The current pandemic situation has limited us in this. However, we hope that in the future we will be able to verify our model on several samples.

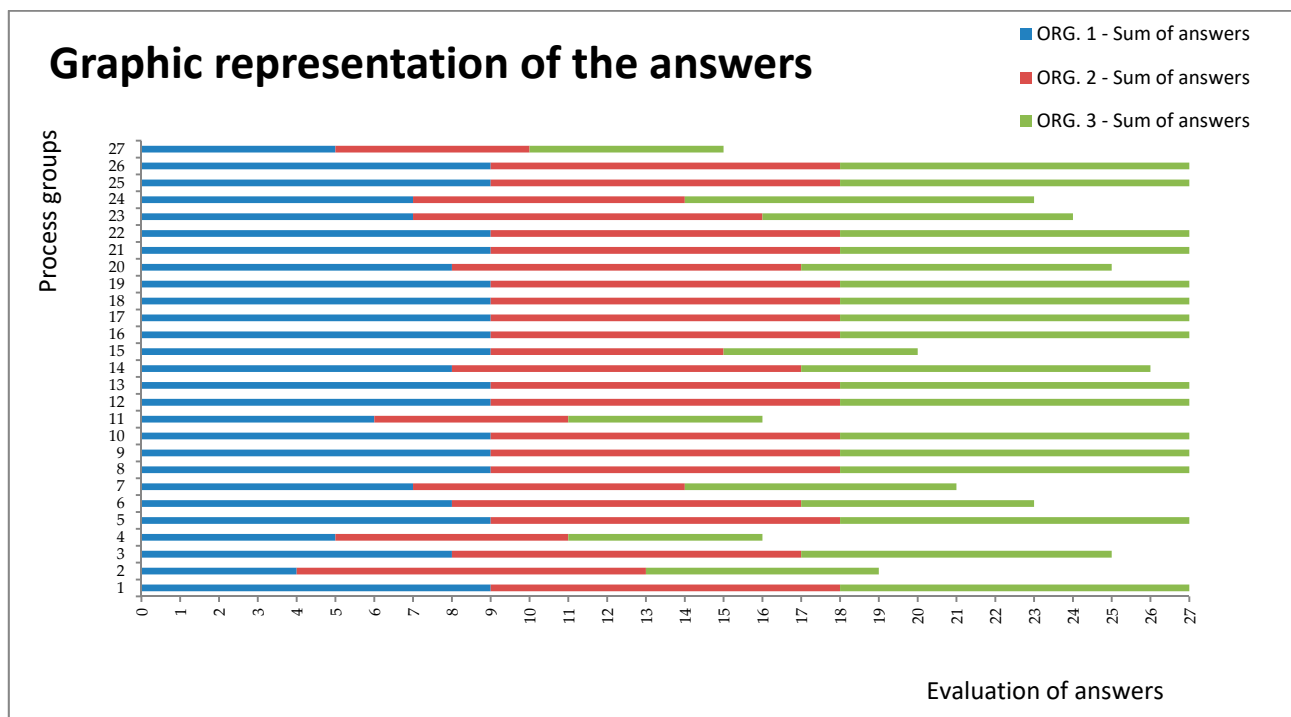


Figure 3. Graphic representation of the answers. Source: own research.

5. Discussion

Three process groups: 4 Develop project plans, primary inputs and outputs; 11 Plan quality; 27 Collect lessons learned, which reached less than 60% of the total evaluation, were the subject of a deeper analysis. Process group 4 Develop project plans, primary inputs and outputs reached up to four minimum values in scoring, which is related to the fact that, according to them, these activities are included in part 5—Define scope—where the goals or project outputs are primarily determined. Process group 11 Plan quality reached minimum values in evaluation 3, which was since they do not perceive the quality management process as part of project management. In the implementation, it is paramount for them not to exceed the budget and time. According to the respondents, system quality management is more of a formal matter. The last group rated low was 27 Collect lessons learned. In this case, the low rating was justified by the fact that this task is in the competence of management, and even though they see a benefit in the implementation of this step, they do not implement it. Personally, we see a parallel with the culture of the organization itself. Small- and medium-sized enterprises often lack the so-called soft processes, i.e., processes that deal in detail with errors from previous experience or the implementation of preventive measures.

In addition, by analyzing and evaluating the information obtained directly from the researchers/respondents in individual organizations, we found various advantages but also disadvantages of the model, as well as suggestions for its improvement. Organization 1 described the model as sufficiently helpful, but in its implementation, there was a proposal to regroup certain processes. The process described as a lesson learned should be applied in each process group. According to them, the determining direction of project management also depends on the form of financing, which is closely related to the risk management process. It is the financing that represents a risk that can affect not only the management but the entire implementation of the project. It would also be appropriate to define more precisely the management of processes that are implemented in projects in the form of outsourcing, or the simulation process, i.e., verification of the functionality of the final product. Therefore, management and control should create an “umbrella” and continuously monitor the whole project, as stated in the original ISO 21500 standard. According to them, the issue of intellectual property is also critical, which becomes an important discussion.

Organization 2 chose a research project for verification that belonged to the scheme of state projects where the process of implementation, as well as control, was managed by the state. In this case, the key shortcoming was communication, time delays but also ambiguous information from the client. There were unclear instructions in the identifying documents that caused the downtime. The absence of clear answers was also reflected in the financing of the project, which brought an increase in the risk of late procurement of machines and non-compliance with deadlines. Organization 2 also identified the intellectual property as a problematic issue.

Organization 3 proposed a change of order of selected process groups. The decision-making team for the organization became the solution team, from which a group of stakeholders later derived. This change is important because, after the creation of the solution team, it is possible to identify whether all planned processes can be performed independently or to invite an external partner to the project solution. At the same time, the organization strongly supported the use of simple software applications, which should be used from the beginning, and at the same time, focused mainly on two basic attributes, i.e., finance and time. Based on the findings from the verification of the proposal, the final SMEPM model was created, which was based on the ISO 21500 standard, as well as the original model called Model B. In the final model called SMEPM, the comments provided by the management of Organizations 1, 2, and 3 were considered—see Figure 4.

SMEPM presents the final proposal of project management processes for SMEs. The original 27 process groups were replaced by 29 process groups and at the same time, three milestones (i.e., M1, M2, and M3) were added, which formed critical gateways to the individual phases of the project.

The proposed model was adjusted to individual groups according to the life cycle of the project, and some process groups were eliminated or added. When implementing a project according to a model proposed by us, the organization should start with Milestone No. 1, which would summarize the knowledge from previously solved projects. In the first initiation phase, it should focus on three process groups: Develop project charter, Identify stakeholders, and Establish a project team. The outputs from this phase should be the input for the analysis in Milestone No. 2 and then to the process groups of the planning phase (process groups 4 to 14). Planning is followed by Milestone No. 3 and the implementation phase (process groups 15 to 19). Planning, as well as implementation, require constant monitoring, change of management, as well as design, and implementation of measures. For this reason, the controlling phase (process groups 20 to 27) covers both planning and implementation. During the implementation of all phases, data should be systematically collected in the organization, which in the end will serve as a basis for the lesson learned process group (process group 29). The final part—closing—therefore, consists of closing the project and summarizing the knowledge.

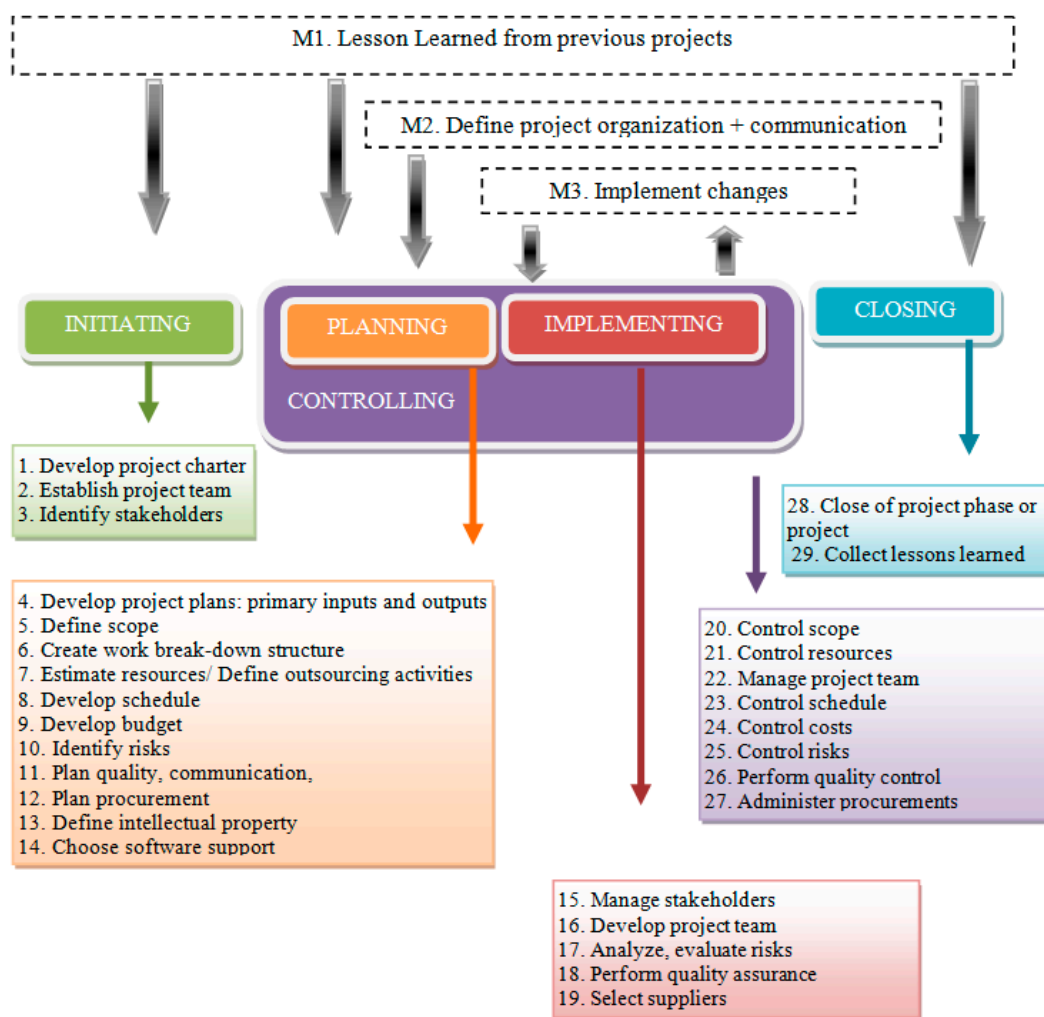


Figure 4. SMEPM—a model for project management in SMEs. Source: own research.

As mentioned in the article introduction, project management in an SME is often a matter of operational management without the use of common techniques and employees with experience in project management. There are currently several software applications on the market that help implement projects, but each project also includes a process that is not possible to manage with software, and that is communication. The proposed SMEPM model, with its structure and the creation of three separate milestones, gives space for constant communication and acceptance of changes. They need not only be technical, time, and financial risks but also risks associated with changes in legislation, stakeholders but also new proposals. The ISO 9001: 2015 standard refers in its content to the approach called risk based thinking, which also includes a positive view of risks, which are transformed by it into opportunities [69]. For this reason, the model we propose appears to be sufficiently flexible and open to accept new risks/opportunities and, at the same time, systematic enough to become a suitable and usable tool for project management in SMEs [70].

6. Conclusions

The current situation in the industry is putting pressure on the use of various “alternative” methods that will support the standard functioning of the organization. It is therefore usual for organizations to look for new sources of funding, in addition to carrying out their usual activities to be able to ensure their functioning. One option is to actively engage in projects that are funded with new external resources. However, it is difficult to implement projects in a commercial organization if the top management or the employees themselves have no experience and, for time reasons, no space for detailed preparation of

their implementation. Just as a regular customer in a store assesses a product and not the processes of its implementation, so the customer for whom the project is intended assesses the results and impacts that cannot be ensured without effective management.

For this reason, the proposed SMEPM model could help SMEs to implement such projects. The given methodology enables the implementation of the project according to the verified sequence of the ISO 21500 standard, also considers risk management, and gives space for the use of software support, as well as changes required by the project. Future research will focus on the verification of the proposed model in various specific areas of operation of SMEs, e.g., with a focus on automotive manufacturing, asset management [71], and its extension to the development of different product categories [72]. For further future improvement we are planning to scientifically validate and justify the difficulties of SMEs for adopting existing models and standards with the suitable survey.

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