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RESEARCH PAPER

The Evaluation of PMBOK Framework for the Management of Small-sized Projects

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ABSTRACT
The Project Management Body of Knowledge (PMBOK) is a widely used model of project management based on prior experience. This standard does not distinguish between small and large projects, but small-sized projects, with their limited schedules and budgets, face challenges using the extensive structure proposed by this standard. It has been suggested that the standard can be adapted to each project within its specifications; however, the tailoring procedures are complex, time-consuming, and at times impossible to apply to small-sized projects. The present study examined whether or not the PMBOK is an appropriate model for small-sized projects. To address this issue, a questionnaire was prepared and sent to 134 professional project managers. Analysis of the data confirmed that the assumption that PMBOK is a challenge to small-sized projects was not contradicted. Most participants agreed that the procedure should be tailored to prioritize the standard tools and guiding techniques, in addition to the knowledge areas, for small-sized projects. Therefore, this model should be tailored and a simplified or lite version of it for small-sized projects should be provided.

KEYWORDS: *Small-sized projects; Project management; PMBOK; Project management lite; Tailoring.*

1. Introduction

Project management is not new, but input from executive experience, transforming implicit knowledge into explicit knowledge, and developing a science of project management could result in a cohesive framework within which projects can be optimally managed [14]. Existing project management methodologies tend to take different approaches to solving the challenges facing a project [13]. Project management is the key to project success, but appropriate project management practices are required to achieve complete success [7].
[6] shown that the application of appropriate project management methodologies and practices can produce a 22.3% change in project success. One of the best-known approaches is the American standard of project management as defined in the Project Management Body of Knowledge (PMBOK). This guidebook purports to provide a competent solution for the majority of projects in the majority of times. According to the guidebook: "This PMBOK guide identifies a subset of project management body of knowledge that is generally recognized as good practice" [14]. However, this guide is a work in progress.
Project management practices are influenced by the ecosystem and environment in which they develop. In recent decades, the focus of research has been on megaprojects [4], and it seems that the development of a project management methodology and practice has been strongly influenced by this research. This is why these practices require modification to be useful under different conditions, such as in smaller project. For example, efforts have been made to develop sustainable project management [5] and green project management in recent years [17]. To achieve sustainable project management, project management practices must be adapted [12].
The modification and adaptation of project management practices and methodology to provide project success is always a consideration [23]. [22] compared the practices and methodologies of project management, such as traditional and agile, and emphasized the

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necessity of customization of project management practices and methodology to make them appropriate for a project's specifications and environment.

Adaptation of project management methodology and practice can take different forms. [26] considered adaptions that include the latest information technology. In other cases, adaptation of project management methodology accounted for the systematic practices of the project organization [8]. [1] examined project management practice from the perspective of governance and based on organizational strategies. [15] studied agile project management practices and emphasized that adapting it to a specific project requires tailoring for size and the specific organization.

Recent additions to the PMBOK include concepts such as tailoring and agile management, both of which were not the center of attention before their inclusion in this guide. The PMBOK states that it should not be regarded as a methodology per se, but requires tailoring [14] according to the specifics of each project. Agile management is an approach to management which is suited to projects with high levels of uncertainty.

An important feature of any project is its size, which has certain requirements [19] and may require modifications resulting from resizing. One example of this is [2], who studied the requirements for management of small construction projects in Thailand. Some research has only examined one aspect of project management knowledge area, such as risk management. [21] studied the requirements for risk management in small construction projects. [5] studied this for small construction projects in Singapore. [11] evaluated the issue of size-based adaptation in small organizations.

Each project can be categorized as small, medium, or large depending upon the perspective of the viewer. Small-sized projects have specific limitations which means they require a particular management approach. This is where the concept of tailoring comes into play, to adapt a particular management method to a specific project. PMBOK considers tailoring to be a high-level undertaking which can be only achieved by experts [14], which brings up a number of issues. This undertaking requires a budget and time span as well as determining possible experts on hand in a small-sized project. The number of limitations in a small-sized project may make it unfeasible. Also, it is evident that planning a trek to Everest requires different planning than a hike in the local park. Tailoring the process of planning for a trek up Everest to fit a local hike would be a difficult task.

The focus of the current study was to determine whether or not the current PMBOK standard is an appropriate model for management of small-sized projects. The use of tailoring to adjust the management model for a small-sized project could require time, incur costs, and require experts that are in short supply. It might be possible to compare specific requirements for a number of small-sized projects to those of larger ones and then tailoring them in order to determine an appropriate management model for all small-sized projects. The present study assessed the need to create such a model by consulting experts in the field. Such a lite model for project management is not meant to replace the PMBOK framework, rather assignment of tailoring principles according to the size of a project requires experts and resource-intensive undertakings that should be established according to PMBOK. These principles can then be applied to similar small-sized projects. Tailoring for the specific traits of each project will remain a necessity.

Budget and time limitations are conspicuous traits of small-sized projects. [20] demonstrated the need to scale down project management systems in such projects. [3] compared project deliverables, objectives and scopes, project planning, communications, reporting progress, change management, and risk management in small-sized projects to those in larger ones.

[10] argued that, because the majority of existing frameworks have been designed for large projects, there can be consequences to skipping critical steps to manage such as planning when scaling down for smaller projects. [24] considered the nature of management in medium- and small-sized projects as differing from that of larger projects. They stated that, although models such as PRINCE2 have been developed to deal with medium-sized projects, no substantial attempts have been made to tackle the problems of small-sized projects.

[18] noted that the challenges faced by small-scale projects include planning processes, multifold responsibilities, inexperienced teams, and problems using complicated tools and procedures. The author then proposes a simplified model by tailoring PMBOK standards. This mode is called small and Simple Project Management (SPM) and uses scaled-down procedures and uncomplicated tools. Rowe points to the PALM principle as a component of the SPM.

[9] found that small- and medium-sized projects formed 99.8% of the European economy, which testifies to their importance. They assessed the efficiency of the ISO/IEC 29110 standard for management of small-sized projects.

The present study will be investigated the suitability of the PMBOK framework for small-sized project management and will be attempted to determine if the PMBOK framework in its current form was a challenge to small-sized projects. The necessity of permanent tailoring based on size and a simplified management model for small-sized projects will be investigated by consulting expert opinion. According to this study findings, the current framework of the PMBOK model poses difficulties and challenges for small-sized projects when it is applied without revision. Therefore, this model should be tailored and a simplified or lite version of it for small-sized projects should be provided.

2. Definition of a Small-sized Project

Initially, a definition for a small-sized project is required as a framework to this study. Generally speaking, two characteristics determine how small or large a project is: its size and its complexity. Fig. 1 categorizes projects using these attributes as being either small, medium, or large. However, the it must first be determined if "size" is a variable or the actual attribute measured. This could assess the project cost, time-frame, number of personnel, or something different, such as the complexity of a project, which would be more difficult to quantify.

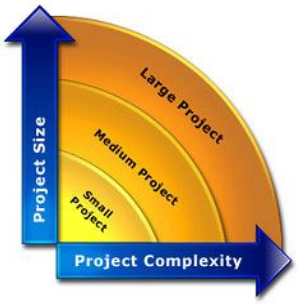

Fig. 1. Project categories according to scale.

In an attempt to define small-sized projects, [18] stated that there is no unified description of a small-sized project. To some, cost is the main criterion; to others, it is time length. The definition developed by Rowe is a project which requires less than six months to complete, has a team of ten or less, requires a small number of skilled areas, has a single objective, is limited in scope, involves one particular business sector with one decision-maker, allows easy access to project information, yields straightforward results, relies on internal skills, and has a supplied cost of less than $75,000. If no particular skills are required to complete the project, but the deliverables are complex, it should be considered a small-sized project [18].

[9] divided projects into small, medium, and large classes based on the project duration, number of personnel and their disciplines, and the project cost (Table 1). They also stated that 95% of projects are small or medium in size.

Tab. 1. Classification of projects according to Laporte and Chevalier (2016)

	Small project	Medium project	Large project
Duration of project	Less than 2 months	2 to 8 months	More than 8 months
Size of team	Up to 4 people	4 to 8 people	More than 8 people
Number of engineering disciplines involved	One discipline	One or more disciplines	More than one discipline
Engineering fees	CAD $5000 to $70,000	CAD $50,000 to $350,000	Over CAD $350,000
Percentage of projects	70%	25%	5%

[10] presented different criteria to differentiate between small and large projects. Table 2, in addition to the project duration and budget, takes into account risks, stakeholders, formality level, and visibility. Thus, it should be evident that there is no clear and unified definition for a small-sized project.

A project with a particular level of specified traits might be considered small in one industry and medium or large in another industry. Because it was not the focus of this study to provide a definition for small-sized projects, such a definition has not been provided. Each participant should define a small-sized project using the most appropriate criteria to the area involved. In other words, one participant might use the industrial context when judging size and another might consider projects from different industries when judging the smallness of a project. Either way, each participant should judge the smallness of a project according to the area of expertise. The respondents in the present study have been asked to specify their level of agreement with the statement that "the most important characteristic of a small-sized project is its short duration and limited budget".

Tab. 2. Classification of projects according to Larson and Larson (2009)

Scale:	Medium-large	Small
Time (hours, months)	Example 1: ≥ 1000 hours	< 1000 hours
	Example 2: > 9 months	≤ 9 months
Budget (CAD)	Example 1: ≥ 100,000	< 100,000
	Example 2: ≥ 20,000	< 20,000
Risk (number or type)	Example 1: sizable	low-moderate
	Example 2: any risk	none
Stakeholders (number or type)	Example 1: > 2	1 or 2
	Example 2: Director level or above	Manager or below
Visibility (level)	Typically high	Often indistinguishable from ongoing work
Formality level (sponsor, PM, team)	Name sponsor, PM, team	Absent/informal sponsor/PM/team; 1-person project teams

3. Literature Review

Several years before management standards became the norm, [20] introduced budget and time limitations as stand-out characteristics of small-sized projects and asserted the necessity of scaling down management systems to make them applicable to such projects. The author then introduced budget, schedule, and product as the main objectives of a small-sized project and the primary factors contributing to its success. The study pinpoints limited budgets and a short duration as the main problems faced by small-sized projects.

[3] investigated whether or not the methodologies designed for large project management are applicable to smaller ones. The management models were considered to be process-centric with a tendency to produce huge quantities of documents. These attributes make their use inappropriate for small-sized projects. The study proposed the development of a computer program which would focus on project deliverables rather than the production of documents. In consideration of the deliverable perquisites, objectives, and scopes, planning method, communications, reporting process, change and risk management, the study concludes that the best approach to small-sized projects are tried-and-true ones which produce the smallest number of documents and have the lowest overhead.

[10] observed distinct differences between the challenges to small and large projects. Because of the limitations experienced by small-sized projects, planning processes are often overlooked in order to reach the execution phase as quickly as possible, which can cause errors and other problems down the line. The authors noted four main challenges faced by managers of small-sized projects: identifying work that is actually a "project", lack of time for planning, insistence on execution and following a plan, and regular controls and tracking of the project. Larson and Larson then attempted to tailor the management framework designed for large projects to make

them suitable for smaller ones. They identified the critical steps required, according to their own experience and the PMBOK structure, and stated that these critical steps should not be skipped, even in smaller projects. The steps were project sanctioning, scope definition, scheduling and estimating, providing a status report, and defining the project closing date and success criteria.

[24] demonstrated the importance of small-sized projects and stated that 99.8% of companies in the European Union were small or medium sized. This constitutes 56% of the EU's GDP, employs 70% of the workforce, and constitutes 20% of the EU economy. They asserted that the nature of small and medium projects is different from that of large ones and models such as PRINCE2 were developed for medium-sized projects while small-sized projects remain neglected. [24] then tried to determine the differences between small and large projects, the role of bureaucracy in the management of small-sized projects, and the important elements of management in a small-sized project. Turner et al. concluded that small and medium projects should be responsible for a "lite" version of project management which is less bureaucratic, with a possible "micro-lite" version for small-sized projects. Even in medium projects, a number of roles can be only filled by experts, unlike in small-sized projects, where such roles either do not exist or are very limited. Each member of the project team usually has multiple responsibilities which can decrease bureaucracy and have primarily informal relationships.

[18] presents a model for the management of small, simple projects and enumerated the challenges to small-sized projects. These challenges include different planning requirements, having a lower priority to an organization, team members having multiple responsibilities that could include working on other projects, and difficulty using complicated tools and processes.

[18] proposed a simple model with concise processes for such projects called Small and Simple Project Management (SPM). Its principles were based on the tailoring process applied to PMBOK. The author reviewed a number of processes involved in project management, including the initiation process, planning processes for small and simple projects, controlling processes, and closing processes. Because some of the SPM processes might prove problematic during emergencies in simple projects, PALM can be applied to the process. PALM comprises four functions: planning project activities; analyzing the situation and asking questions; leading project activities; and monitoring and controlling time and other resources.

[9] emphasized the importance of small and medium projects because of their huge impact on the economy, which confirms the significance of small-sized projects. They refer to the experiences of an American company which enhanced its management processes to make them fit for small and medium projects. The goals of the enhancements were to reduce cost overruns and delays, improve customer satisfaction, and decrease risks. The ISO/IEC 29110 standard was employed and led to a net gain of over $780,000. This company had been using a strong management process for its large-scale projects.

4. Methodology

The present study was conducted to confirm statements about the perquisites for small-sized projects produced in a survey of participants which were experts in project management. It was observational research in which the data was gathered by questionnaire. Fig. 2 shows the research method used. The objective was to demonstrate the challenges of the use of PMBOK for small-sized projects and the need for permanent tailoring of the PMBOK standard to make it fit for small-sized projects.

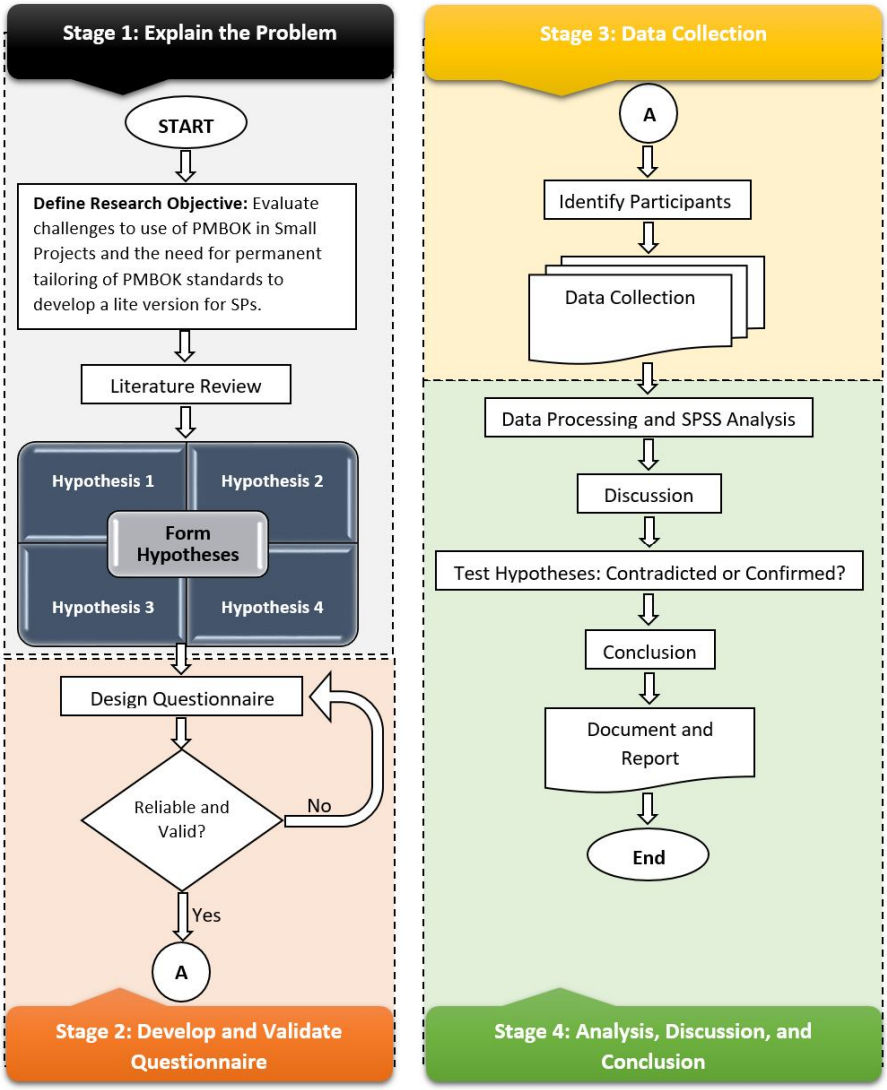

Fig. 2. Research methodology flowchart

The following smaller objective were defined to assess the four proposed hypotheses:

a) Using the PMBOK standard in its original comprehensive form for small-sized projects will lead to challenges and difficulties.
b) It is necessary to develop a solution for this issue by providing a simplified project management model (lite version) for small-sized projects.
c) The challenges and difficulties related to the use of the PMBOK model are for the high number of knowledge areas and tools and techniques and the detailed processes in the PMBOK model.
d) The fourth hypothesis differs from the other three because it relates to project characteristics. It states that the most important aspects of a small-sized project are its short duration and limited budget.

To assess the validity of the first hypothesis, three propositions were proposed. Five propositions were designed to assess the validity of the second hypothesis. The third hypothesis was tested using three propositions. The fourth hypothesis included only one proposition. These were used to design a questionnaire with 12 propositions. All propositions were designed with the hypotheses in mind. The participant responses were rated using a five-option Likert scale: "strongly disagree" = 1, "disagree" = 2, "neutral" = 3, "agree" = 4, "strongly agree" = 5. Table 3 lists the 12 propositions.

The survey was conducted using a web-based questionnaire which respondents accessed by link and for which the invitation was sent by email. Google Forms Platform was used to prepare the questionnaire and each participant received the link to follow to complete the survey. This questionnaire was distributed among project

managers, most of which held PMP certificates. Professional social networks such as Linked-in were used to find and select respondents. The survey was conducted in January/February 2019. Because this was not a standard questionnaire, it was necessary to assess its validity and reliability. A number of experts were consulted to assess the validity and were able to confirm its validity. Cronbach's alpha was used to assess the questionnaire's reliability using the results received from 32 participants. Table 4 shows a Cronbach's alpha value of 0.803, which is higher than 0.7, confirming the reliability of the questionnaire.

Tab. 3. Questionnaire designed for present study

		Propositions
Assessment of participant level of knowledge		How well do you know the PMBOK standard? □ I am a PMP certificated holder. □ I know PMBOK thoroughly. □ I am familiar with other project management standards. □ I am not familiar with project management standards.
Hypothesis 1	HQ-1-1	The use of the PMBOK frameworks for small-sized projects has proven challenging and difficult.
	HQ-1-2	Managing small-sized projects using the frameworks for project management comes with perquisites. The change in scale is not similar to other differences between projects.
	HQ-1-3	The PMBOK is too comprehensive, formal, and bureaucratic to be useful in small-sized projects.
Hypothesis 2	HQ-2-1	The use of current processes and procedures for large projects in small-sized projects is counterintuitive. Foregoing a model would be more beneficial.
	HQ-2-2	The emphasis is on the entire system in large projects and on individuals in small-sized projects; thus, a more simplified project management model can be proposed which would be faster and easier to apply.
	HQ-2-3	In small-sized projects, each individual has multiple responsibilities and the number of expert-oriented tasks is lower than for large projects, which is why the application of a project management model should not require specialized skills and lengthy educational processes.
	HQ-2-4	We need a simplified (lite) model for management of small-sized projects.
	HQ-2-5	We do not have an adequate model, such as the one in the previous proposition, for small-sized project management.
Hypothesis 3	HQ-3-1	The ten knowledge areas in the PMBOK should be condensed and unified before they can be utilized in small-sized projects. There is too much division between them.
	HQ-3-2	The five processing groups of the PMBOK framework should be condensed to make them applicable to small-sized projects.
	HQ-3-3	The PMBOK framework is suitable for application in small-sized projects for processing groups and knowledge areas; however, the tools and techniques proposed should be applied with perquisites for small-sized projects, such as ease and speed of application, otherwise, their application would prove problematic.
Hypothesis 4	HQ-4	The most important characteristics of small-sized projects are their short durations and limited budgets.

Tab. 4. Cronbach's alpha

	Case processing summary		Reliability statistics	
	Number	Percentage	Cronbach's alpha	Number of items
Valid cases	31	96.9	0.803	31
Excluded cases[a]	1	3.1		
Total	32	100		

[a]Listwise deletion based on all variables in procedure

5. Results and Discussion

5.1.Results

A total of 134 participants completed the questionnaires. The information in Table 5 is based on participant self-reporting: 91 (67.9%) were PMP certificate holders, 40 (29.8%) were

familiar with the PMBOK standard, two participants (1.5%) were only familiar with other standards, and 1 participant (0.8%) was not familiar with any project management standard (Fig. 3). Given the centrality of the PMBOK standard to this study, only the 131 participants who were either PMP certificate holders (69.5%) or who were quite familiar with PMBOK standards (30.5 %) were considered for statistical analyses.

Tab. 5. Participant level of familiarity with PMBOK

Level of familiarity	Number	Percentage
PMP holders	91	67.9%
Quite familiar with PMBOK	40	29.8%
Only familiar with other standards	2	1.5%
Not familiar with any project management standard	1	0.8%

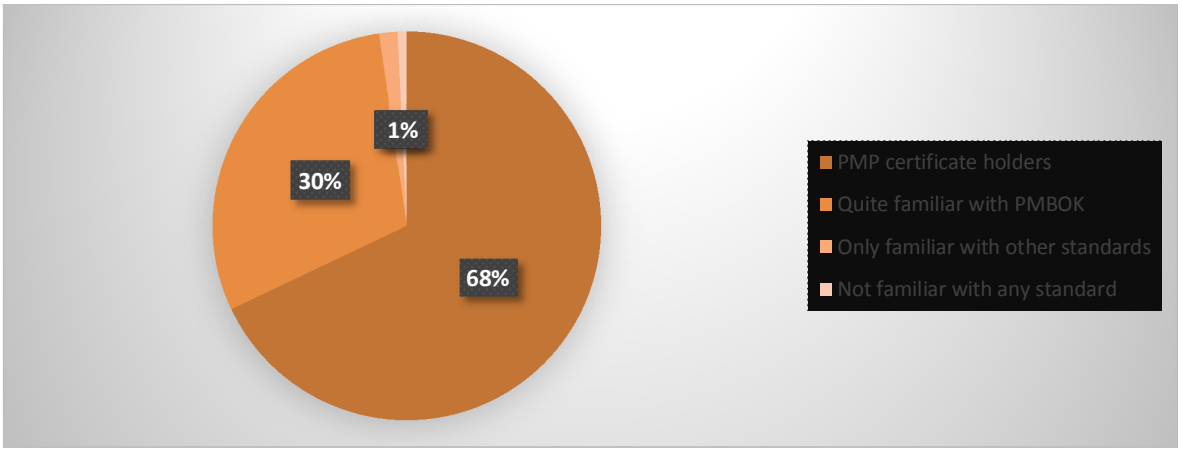

Fig. 3. Distribution of participant familiarity with PMBOK.

The responses provided were divided into four groups according to the questionnaire as seen in Fig. 4. In addition to the frequency of the response for each proposition, the ratio of agreement to disagreement was investigated and reported. To validate this ratio, the binomial test was used.

First group of propositions: Assessment of hypothesis that "using the PMBOK standard in its original form for small-sized projects is challenging and difficult"

Table 3 shows that participants were asked to assess three propositions about the existence or non-existence of problems, difficulties, and challenges caused by the use of the PMBOK model in small-sized project management. The first three propositions were designed to assess the challenge PMBOK would pose for small-sized projects. The replies to propositions HQ-1-1, HQ-1-2, and HQ-1-3 can be seen in Fig. 4.

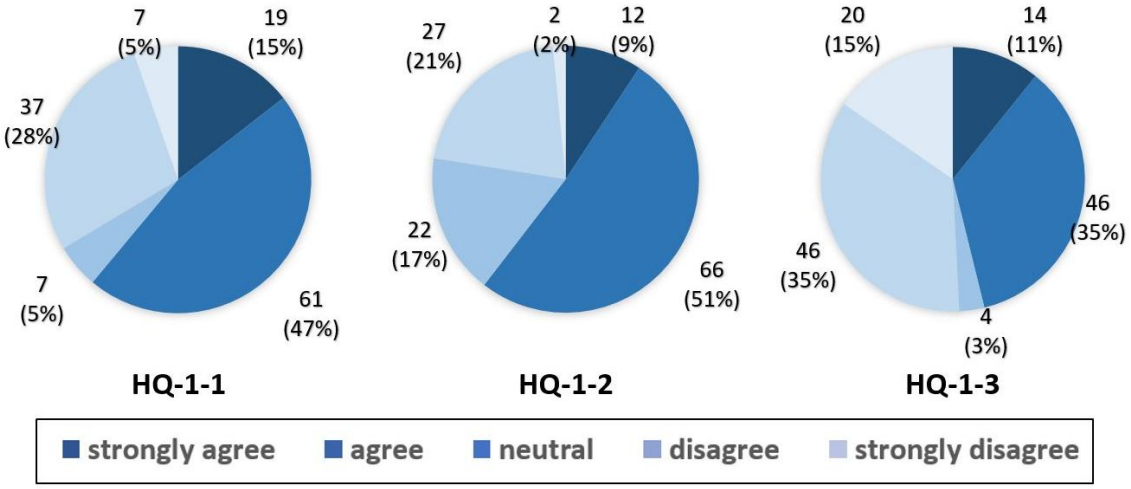

Fig. 4. Distribution of replies to propositions for first hypothesis.

As shown, 80 participants replied to the HQ-1-1 proposition that "using PMBOK standard frameworks in small-sized projects has proven challenging and difficult") with "agree" or "strongly agree." A total of 44 participants replied with "disagree" or "strongly disagree." Binomial testing found that the number in agreement was significantly higher than those in disagreement ($p = 0.002$).

The second proposition was: that "managing small-sized projects using the frameworks for project management comes with perquisites and the change in scale is not similar to other differences between projects". A total of 78 participants replied with "agree" or "strongly agree," and 29 participants with "disagree" or "strongly disagree." The binomial test results indicated that the number in agreement was significantly greater than the number in disagreement ($p < 0.001$). Sixty of the participants replied with "agree" or "strongly agree" to the third proposition that "the PMBOK is too comprehensive, formal, and bureaucratic to be useful in small-sized projects. A total of 66 replied with "disagree" or "strongly disagree." No statistically significant difference was observed between the two groups ($p = 0.656$).

Second group of propositions: Assessment of hypothesis that "developing a solution by providing a simplified project management model for small-sized projects is necessary"

Five of the propositions in the questionnaire addressed the need and importance of tailoring, condensing, and developing a simplified project management model. The participant assessments of the five propositions of this hypothesis are summarized in Fig. 5.

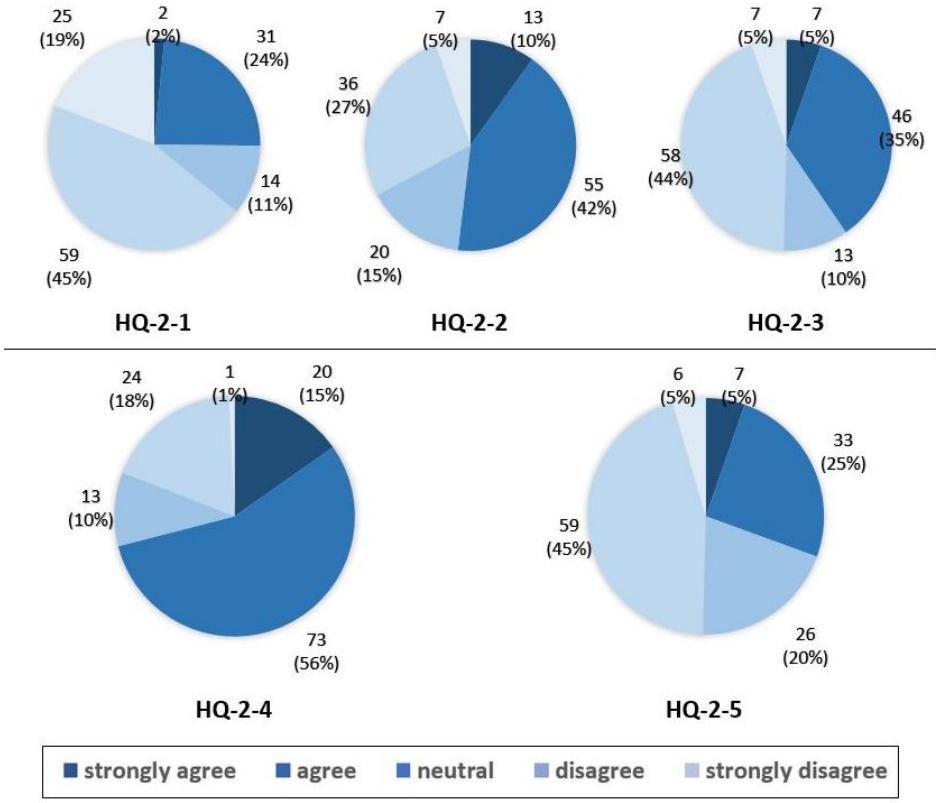

Fig. 5. Distribution of replies to propositions for second hypothesis.

An attempt was made to assess the importance of a simplified PMBOK model by taking different aspects of the issue into account. The systematic aspect, individual responsibilities, and problems of the current model were explored and the need for a simplified model was assessed.

In the HQ-2-1 proposition, the problematic aspects of the current model were probed: "The use of current processes and procedures designed for large projects in small-sized projects is counterintuitive. Foregoing a model would be more beneficial." A total of 33 participants replied to this proposition with "agree" or "strongly agree." Those in disagreement numbered 84. The binomial test showed that there was a significant difference between the proportion of those in agreement with those in disagreement ($p < 0.001$).

Proposition HQ-2-2 investigated the possibility of providing a simplified model with greater ease of use and speed for small-sized projects in which the individual, not the system, plays the central role. Here, 68 participants replied with "agree" or "strongly agree" and 43 with "disagree" or "strongly disagree." The proportion of those in agreement was substantially higher than those in disagreement ($p = 0.022$).

Proposition HQ-2-3 assessed the significance of the expert-oriented tasks and individual responsibilities. A total of 53 participants replied with "agree" or "strongly agree" and 65 were in disagreement. There was no meaningful statistical difference between groups ($p = 0.311$).

In proposition HQ-2-4, the participants were asked if they agreed that a more simplified model should be available for small-sized projects. As shown in Fig. 5, 93 participants replied with "agree" or "strongly agree," and only 25 participants disagreed. The binomial test result was $p < 0.001$; thus, the proportion of those in agreement was significantly higher than those in disagreement. That the majority of participants agreed that a simplified model is necessary.

In proposition HQ-2-5, participants were asked to confirm that currently, there is no simplified model at hand for small-sized projects. Of the respondents, 40 replied with "agree" or "strongly agree," and 65 replied with "disagree" or "strongly disagree." Thus, the majority of participants believed that such a model currently exists. The binomial test returned a p-value of 0.019; thus, the proportion of those in disagreement was significantly higher than those in agreement.

Third group of propositions: Assessment of hypothesis "the challenges and difficulties using the PMBOK model stem from the excess number of knowledge areas and tools and techniques suggested and the scope of the

processes"

This group determined the causes of the inherent difficulties and challenges of the PMBOK model for small-sized projects. Three propositions were presented. Fig. 6 summarizes the replies to propositions HQ-3-1, HQ-3-2, and HQ-3-3.

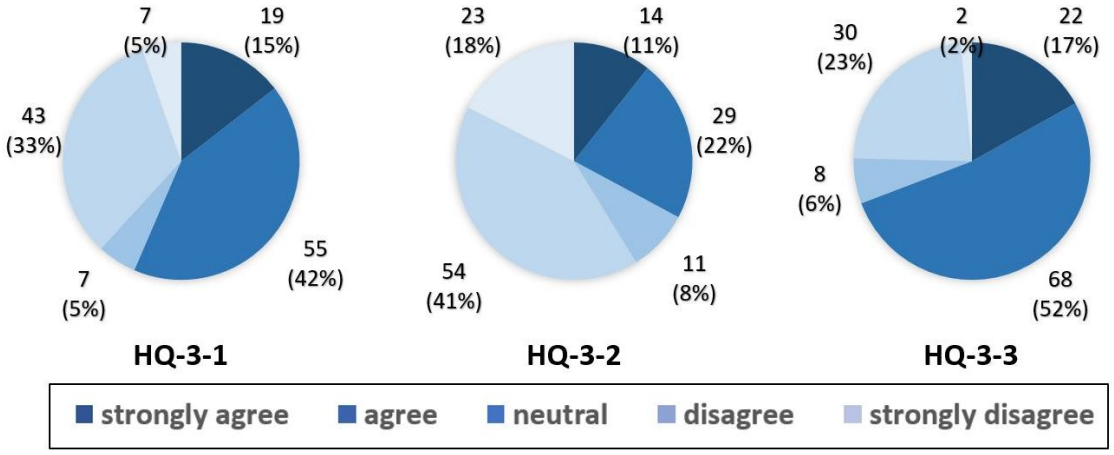

Fig. 6. Distribution of replies to propositions of third hypothesis.

Proposition HQ-3-1 deals with the number of knowledge areas that should be covered in a project management model and introduces the concept of condensing the current processes to make them usable for small-sized projects. Fig. 6 shows that 74 of the participants replied with "agree" or "strongly agree" to this proposition and 50 participants replied with "disagree" or "strongly disagree." The proportion of those in agreement was substantially higher than those in disagreement ($p = 0.038$).

HQ-3-2 states the necessity of condensing the five PMBOK processing groups to make them more suitable for use in small-sized projects. Fig. 6 shows that 43 participants replied with "agree" and "strongly agree" and 77 replied with "disagree" or "strongly disagree." The number of those in agreement was significantly lower than those in disagreement at $p = 0.002$.

Fourth group of propositions: Assessment of the hypothesis that "the most important characteristics of small-sized projects are their short duration and limited budgets"

The last proposition of the third group, HQ-3-3, addressed the need to condense the application tools and techniques in the PMBOK model. A total of 90 participants replied with "agree" or "strongly agree" and only 32 participants replied with "disagree" or "strongly disagree," which produced a statistically significant difference between groups ($p < 0.001$).

The fourth group differed from the other three groups. Here, the hypothesis was that the most important aspects of a small-sized project are its short duration and limited budget. The replies are shown in Fig. 7. As seen, 83 participants replied with "agree" or "strongly agree," while only 31 participants replied with "disagree" or "strongly disagree." The binomial test indicated that the proportion of those in agreement was statistically greater than the other group ($p < 0.001$).

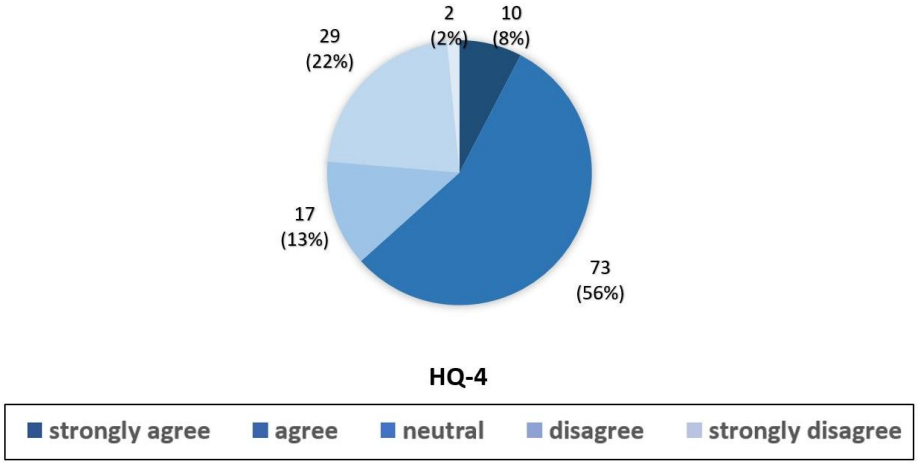

Fig. 7. Distribution of replies to proposition of fourth hypothesis.

5.2. Statistical analysis and discussion of the results

The responses in the questionnaire were evaluated on a Likert scale with five options in which scores greater than 3 denoted agreement with the hypothesis and less than 3 denoted disagreement. A score of 3 was considered to be the neutral point. Given that the response to each of the questions ranged from 1 to 5, the subscale should fall into the same range.

5.2.1. Testing of hypotheses

5.2.1.1.Testing of first hypothesis

Three propositions were used to test the first hypothesis in the questionnaire. The mean of the responses for each proposition was calculated in order to construct the subscale corresponding to this hypothesis for each respondent. Table 6 shows the descriptive statistics of the subscale.

Tab. 6. Descriptive statistics of subscale for first hypothesis

Mean	Median	SD	Minimum value observed	Maximum value observed
3.24	3.33	0.932	1	5.0

The mean and median scores for this subscale were 3.24 and 3.33, respectively; thus, the average scores of this subscale were greater than the neutral number of 3. In order to determine if the mean scores were significantly greater than neutral, the Lilliefors test, which is a corrected Kolmogorov-Smirnov test, was used to test the normality of the distribution. The results of this test are shown in Table 7.

Tab. 7. Lilliefors test results for first subscale

Descriptive statistics	Degrees of freedom	p-value
0.129	131	< 0.001

The probability of this test was less than 0.05; thus, the subscale scores were not normally distributed. The one-sample Wilcoxon signed rank test then was used to test the equivalence of the subscale scores with a neutral value of 3. The results are shown in Table 8.

Tab. 8. Test of first subscale scores having a neutral value of 3

Mean	Median	Wilcoxon descriptive statistics	p-value
3.24	3.33	4627.5	0.005

The Wilcoxon test statistic was 4627.5 at p = 0.005. Given that the probability of this test was less than 0.05, it can be concluded that the mean scores of the first subscale were significantly higher than the neutral value of 3 and the first hypothesis can be accepted. In other words, the responses confirm the hypothesis that using PMBOK comprehensive structure to manage small-sized projects is challenging and entails problems and difficulties.

5.2.1.2.Testing second hypothesis

This hypothesis was measured using five propositions; thus, the mean of the responses for these five statements was calculated. The descriptive statistics of the subscale are shown in Table 9.

Tab. 9. Descriptive statistics of subscale for second hypothesis

Mean	Median	SD	Minimum value observed	Maximum value observed
3.01	3.00	0.720	1.4	5.0

The mean score for this subscale was 3.01, which is very close to the neutral value of 3. The Lilliefors correction for the Kolmogorov-Smirnov test was used to test for a normal distribution for these values and the results are shown in Table 10.

Tab. 10. Lilliefors test results for second subscale

Descriptive statistics	Degrees of freedom	p-value
0.099	131	0.003

At $p < 0.05$, the third subscale can be said to deviate from the normal distribution; thus, the non-parametric one-sample Wilcoxon signed rank test was used to test the hypothesis that the subscale scores were significantly different from the neutral value of 3. R programming software was used for this test and the results are shown in Table 11.

Tab. 11. Test of first subscale scores with a neutral value of 3

Mean	Median	Wilcoxon descriptive statistics	p-value
3.01	3.00	3359	0.948

The Wilcoxon test results was 3359 at $p = 0.948$. Because the probability was greater than 0.05, the observed difference was not significant and the third subscale scores were not significantly different from the neutral value of 3.

The results show that the second hypothesis about the importance of modification of the standard for small-sized projects was not confirmed. However, given that the scores were not significantly different from the neutral value, there was no evidence of respondent opposition to this hypothesis. Nevertheless, some of the propositions, such as the fifth, appeared to be ambiguous and further investigation of the hypothesis is required because some respondents may have responded negatively to the fifth proposition by considering Rowe's model or the ISO/IEC 29110 standard, about which Laporte puts forth significant points. It should be noted that in the fourth statement, 93 (70%) respondents agreed about the need to provide a model for the management of small-sized projects.

5.2.1.3.Testing third hypothesis

The third hypothesis examined which factors of the PMBOK standard for managing small-sized projects were most challenging. These factors that were confirmed through testing of the first hypothesis: field of knowledge, processes, tools and techniques. The responses are summarized in Table 12.

Tab. 12. Replies to propositions of third hypothesis

Proposition	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
First proposition (field of knowledge)	19 (14.5%)	55 (42%)	7 (5.3%)	43 (32.8%)	7 (5.3%)
Second proposition (processes)	14 (10.7%)	29 (22.1%)	11 (8.4%)	54 (41.2%)	23 (17.6%)
Third proposition (tools and techniques)	22 (16.9%)	68 (51.9%)	8 (6.1%)	30 (22.9%)	2 (1.5%)

For each proposition, the "agree" and "strongly agree" replies were considered together and the "disagree" and "strongly disagree" replies were considered together. The binomial test was used to compare the proportion of each group and the results are listed in Table 13.

Tab. 13. Binomial test results

Proposition	Agree	Disagree	Descriptive statistics	p-value
First proposition (knowledge areas)	74 (60%)	50 (40%)	0.5	0.038
Second proposition (processes)	43 (36%)	77 (64%)	0.5	0.002
Third proposition (tools and techniques)	90 (74%)	32 (26%)	0.5	< 0.001

Table 13 shows that the proportion of those in agreement with the first proposition was significantly higher than those who did not agree ($p = 0.038$). Significantly more participants disagreed than agreed with the second proposition ($p = 0.002$). The proportion of those in agreement with the third proposition was significantly higher than those who disagreed ($p < 0.001$). The Friedman test was used to determine the priority for the knowledge areas, processes, and tools and techniques. The results are shown in Table 14.

Tab. 14. Friedman test results for comparison of three areas

Proposition	Mean rank	Descriptive statistics	Degrees of freedom	p-value
First proposition (knowledge areas)	2.06	46.130	2	< 0.001
Second proposition (processes)	1.65			
Third proposition (tools and techniques)	2.29			

Table 14 shows that the third proposition (tools and techniques) had the highest mean rank, meaning this area had the greatest number of participants in agreement; thus, it had the highest priority. The first proposition (knowledge areas) ranked next in priority and the second proposition (processes) ranked lowest. Because the p-value of this test was less than 0.005, a statistically significant difference existed between the priority of the tools and techniques area versus processes. The Friedman test was used to investigate the difference between tools and techniques and knowledge areas. The results are shown in Table 15.

Tab. 15. Friedman test results for tools and techniques versus knowledge areas

Proposition	Mean rank	Descriptive statistics	Degrees of freedom	p-value
First proposition (knowledge areas)	1.43	4.909	1	0.027
Third proposition (tools and techniques)	1.57			

Table 15 shows that the priority of the third proposition (tools and techniques) was significantly higher than the first proposition (knowledge areas). Table 16 shows the difference between the first proposition (knowledge areas) and the second proposition (processes) using the Friedman test.

Tab. 16. Friedman test results for knowledge areas versus processes

Proposition	Mean rank	Descriptive statistics	Degrees of freedom	p-value
First proposition (knowledge areas)	1.63	18.864	1	< 0.001
Second proposition (processes)	1.37			

5.2.1.4.Testing the fourth hypothesis

The fourth hypothesis had only one proposition to investigate: "The most important characteristics of small-sized projects are their short duration and limited budget." To assess the level of agreement or disagreement the "agree" and "strongly agree" replies were considered together and the "disagree" and "strongly disagree" replies were considered together. The binomial test was used to compare the two groups and the results are shown in Table 17.

Tab. 17. Results of binomial test for fourth hypothesis

Agree	Disagree	Descriptive statistics	p-value
83 (73%)	27 (31%)	0.5	< 0.001

The binomial test indicated that the proportion of those in agreement was significantly greater than those who disagreed. The scores for this proposition were then compared with a neutral value of 3 in the one-sample Wilcoxon test. The results are shown in Table 18.

Tab. 18. Results of fourth subscale with a neutral value of 3

Mean	Median	Wilcoxon descriptive statistics	p-value
3.46	4.00	4844.5	< 0.001

The mean and median of the fourth subscale was 3.46 and 4.00, respectively. The Wilcoxon descriptive statistics had a value of 4844.5 at $p < 0.001$. It can be observed that the scores of this subscale were significantly higher than the neutral value of 3. Given the results, the fourth hypothesis was accepted. In other words, it could be said that the participant replies confirmed the fourth hypothesis.

According to this findings, the framework of the PMBOK poses difficulties and challenges for small-sized projects. Therefore on the base of consulting expert opinion, the permanent tailoring based on size and a simplified management model for small-sized projects is necessery. The all finding will be described briefly in the next section.

6. Conclusion

The objective of the present study was to investigate the suitability of the PMBOK standard in its current form for small-sized project management. This study attempted to determine if the PMBOK model in its current form was a challenge to small-sized projects. The necessity of developing a permanent tailoring procedure based on size and a simplified management model for small-sized projects was investigated by consulting expert opinion. A questionnaire with four hypotheses and a total of 12 propositions was prepared and presented to 131 experts, and statistical analysis was conducted on responses. The results were as follows:

- The first hypothesis was not contradicted; thus, the use of the PMBOK model in its current form for small-sized projects will cause difficulties and challenges. This confirms the findings of [20], [3], [24], [18], [9], [10], and others.
- The second hypothesis was neither confirmed nor contradicted. It can be said that the present study regarding the importance of PMBOK tailoring for small-sized projects and provision of a simplified project management model was sufficiently extensive. It appears that the proposition design for this section requires reevaluation. For example, many participants disagreed with the fifth proposition. This could relate to the progress made by [18] and [9], or the availability of models such as ISO/IEC 29110. Thus, the current hypothesis appeared to be too vague. However, for the fourth proposition of this hypothesis, 70% of participants agreed that a simplified or "lite" model for small-sized project management is necessary.
- The third hypothesis was not contradicted. The results indicate that, when condensing and tailoring the PMBOK model for small-sized projects, tools and techniques have the highest priority, followed by knowledge areas. Also, condensing the processes was not as appealing as the other two areas showing meaningful trends. It can be said the third hypothesis was more similar to the views presented by [10] and less similar to those presented by [18].
- The fourth hypothesis, which considers a short duration and limited budget the most important characteristics of small-sized projects was confirmed.

According to these findings for the four hypotheses, the current framework of the PMBOK model poses difficulties and challenges for small-sized projects when it is applied without revision. Therefore, this model should be tailored and a simplified or lite version of it for small-sized projects should be provided. During such a revision, the highest priority should be on simplifying the tools and techniques in the PMBOK guidebook followed by the knowledge areas.

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