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Relationships between a project management methodology and project success in different project governance contexts

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Abstract

This study looks at the relationship between the use of a project management methodology (PMM) and project success, and the impact of project governance context on this relationship. A cross-sectional, world-wide, online survey yielded 254 responses. Analysis was done through factor analysis and moderated hierarchical regression analysis. The results of the study show that the application of a PMM account for 22.3% of the variation in project success, and PMMs that are considered sufficiently comprehensive to manage the project lead to higher levels of project success than PMMs that need to be supplemented for use by the project manager.

Project governance acts as a quasi-moderator in this relationship. The findings should benefit project management practitioners by providing insights into the choice of PMM in different governance contexts. Academics should benefit from insights into PMMs' role as a success factors in projects.

Keywords: Project management methodologies; Project success; Project governance; Contingency theory; Project context

1. Introduction

Project success is one of the most researched topics in project management, but the meaning of the term "success" varies substantially (Judgev and Müller, 2005). Cooke-Davies (2002) makes the distinction between *project success* which is measured against the overall objectives of the project, and accomplished through the use of the project's output, and *project management success* which is measured at the end of the project against *success criteria*, such as those relating to internal efficiency, typically cost, time, and quality (Atkinson, 1999). The accomplishment of these criteria can be influenced throughout the project life cycle through *success factors* (Müller and Turner, 2007).

One of these factors is the project management methodology (PMM), which is meant to enhance project effectiveness and increase chances of success (Vaskimo, 2011). Thus, PMMs were developed to support project managers in achieving more predictable project success rates. However, the extent that this objective is reached is unknown as projects still fail to reach their goals (Lehtonen and Martinsuo, 2006; Wells, 2013) and a quantification of the impact of PMMs on project success is still missing. Examples of internationally recognized PMMs include Prince 2 from Office of Government Commerce (OGC, 2002), The System Development Life Cycle (SDLC) (Ruparelia, 2010), and Erickson's PROPS (Ericsson, 2013), whereas PMI Project Management Body of Knowledge (PMBoK) is a body of knowledge and not a methodology (PMI, 2013).

Project management literature distinguishes between standardized versus customized PMMs (Crawford and Pollack, 2007; Curlee, 2008; Fitzgerald et al., 2002; Milosevic and

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Patanakul, 2005; Shenhar et al., 2002a), and is divided on whether standardized PMMs, customized PMMs, or a combination of both enhances project effectiveness, hence leading to a higher chance of project success (Curlee, 2008; Milosevic and Patanakul, 2005; Shenhar and Dvir, 1996).

A related perspective is the comprehensiveness of a PMM and its impact on project success (Fortune et al., 2011; Wells, 2013; White and Fortune, 2002). The premise of being able to standardize and/or customize a methodology is underlying the assumption that the PMM will become comprehensive, that is, sufficient for any given project.

When an organization's PMM is incomplete or limited (missing methodology elements), project efficiency, quality, and ultimately the probability of project success will be impacted. Fortune et al. (2011) showed that more than 50% of the respondents in their study experienced limitations using PMMs. Among the most mentioned were limitations in methods, processes, tools, and techniques. A method is a set of procedures, to be used by humans, for selecting and applying a number of techniques and tools in order, efficiently to achieve the construction of efficient artifacts. (Bjorner & Druffel, 1990). Simply put, a method is what is applied in a particular situation and a methodology is the sum of all methods and the related understanding of them.

Wells (2013) and Joslin and Müller (submitted for publication-a) found that PMMs vary in completeness and appropriateness from organization to organization. Some are considered inadequate for certain types of projects. These reported issues suggest that it is not sufficient to look at a PMM as a whole, especially as every PMM is a heterogeneous collection of practices that vary from organization to organization (Harrington et al., 2012). In this paper, the elements of a PMM are first defined and then they are investigated as to their collective impact on project success in governance contexts.

Governance pervades organizations. "Corporate governance encompasses all work done in an organization, and thus governs the work in traditional line organizations, plus the work done in temporary organizations, such as projects" and project governance is a subset of corporate governance (Müller et al., 2013, p. 26). The definition of corporate governance have been taken from the Organization for Economic Co-operation and Development (OECD) is:

"Involving a set of relationships between a company's management, its board, its shareholders and other stakeholders [...] and should provide proper incentives for the board and management to pursue objectives that are in the interests of the company and its shareholders and should facilitate effective monitoring OECD (2004, p. 11)". Corporate governance influences project governance as an oversight function which collectively encompasses the project lifecycle to ensure a consistent approach to controlling the project with the aim of ensuring its success.

Since 2005, the literature on governance in the realm of projects grew exponentially (Biesenthal and Wilden, 2014). However, the role of PMMs in different governance contexts has attracted very little attention in the past. An exception is the study by Joslin and Müller (submitted for publication-b) which showed that project governance, which is defined as "the use of systems, structures of authority, and processes to allocate resources and coordinate or control activity in a project" (Pinto, 2014, p. 383), may influence the effectiveness of using PMMs to achieve project success. A further refinement of this result is indicated through (a) a quantitative approach that allows for generalizable results and (b) more granularity in the identification of the particular elements of a PMM that relate to project success.

The aim of this study is to further investigate the relationship between a PMM and its elements with project success, and how this relationship is impacted by different project governance contexts. Consequently, the following research question is proposed:

> What is the nature of the relationship between a PMM and project success and is this relationship influenced by project governance?

The unit of analysis is the relationship between the PMM and project success. In line with the nature of the research question, the study takes a contingency theory perspective.

The results of the study will provide a better understanding of an organization's PMM in terms of the impact of a PMM on project success, and how different project governance contexts influence the selection, effectiveness, and comprehensiveness in the use of PMMs.

These findings help organizations to understand how to align their PMMs to optimize effectiveness in use, which should result in higher project success rates and reduce the complaints about ill-fitting PMMs.

This paper continues by reviewing the related literature, which is followed by the methodology and analysis sections. The paper finishes with a discussion and conclusions and provides the survey questions in the Appendix A and B.

2. Literature review and hypotheses

This section reviews the literature on project success, project PMMs, and governance from which the hypotheses are derived and describes contingency theory as the theoretical perspective.

2.1. Project success

Since the 1970's, academics have tried to understand what project success is and which factors contribute to it (Ika, 2009). However, its meaning is still not generally agreed upon (Judgev and Müller, 2005). Project success is a multidimensional construct that includes both the short-term project management success *efficiency* and the longer-term achievement of desired results from the project, that is, *effectiveness and impact* (Judgev et al., 2001; Shenhar et al., 1997).

To achieve a common understanding of what project success is, it should be measurable and therefore defined in terms of success criteria (Müller and Turner, 2007). The understanding of project success criteria has evolved from the simplistic triple constraint concept, known as the iron triangle (time, scope, and

cost), to something that encompasses many more success criteria (Atkinson, 1999; Judgev and Müller, 2005; Müller and Judgev, 2012; Shenhar and Dvir, 2007). Measurement models for success that are applicable for different types of projects or different aspects of project success were developed, among others, by Pinto and Slevin (1988a), Shenhar et al. (2002b), Hoegl and Gemuenden (2001), and Turner and Müller (2006).

At the same time, project success factors became a popular theme in research (e.g. Belassi and Tukel, 1996; Pinto and Slevin, 1988; Tishler et al., 1996; White and Fortune, 2002). Factors can be categorized into environmentally related (meaning where the project resides) (Fortune and White, 2006; Hyväri, 2006; Jha and Iyer, 2006), people-related (Tishler et al., 1996), processes- and tools-related, (Jessen and Andersen, 2000; Khang and Moe, 2008; Shenhar et al., 2002b), and just generally context-related (Sauser et al., 2009). In absence of a formal definition for project context, the definition of the term "context" has been adapted from Abowd et al. (1999): *Project context is any information that can be used to characterize the situation of project which includes physical and mental aspects. The physical aspects of project context include previous projects as well as the project environment where the project actually resides, whereas the mental aspects includes social, emotional, or informational states.*

Schultz et al. (1987) suggested that the relative importance of success factors varies over the project life cycle. Shenhar et al. (2001) described the importance of success factors not just on the project life cycle but also on the product life cycle from project completion to production, and then to preparation for project/service replacement. Researchers soon realized that success factors without structure, grouping, and context would result in increased project risks; therefore, success factor frameworks were introduced (Judgev and Müller, 2005). Pinto and Slevin (1988) developed a success framework covering organizational effectiveness, technical validity, and organizational validity. Freeman and Beale's (1992) success framework included efficiency of execution, technical performance, managerial and organizational implications, manufacturability, personal growth, and business performance. Shenhar et al (2001) described that no one-size-fits-all exists by using a four-dimensional framework, showing how different types of projects require different success factors, determined by the strategic nature and the short- and long-term project objectives.

Khan et al. (2013) developed a model of success factors derived from a literature review of the past 40 years. Their model offers a balance between hard and soft factors and measures success using 25 variables organized in five dimensions. The model contains the three criteria for the iron triangle (dimension 1) plus four additional project success criteria dimensions:

1. Project efficiency,
2. Organizational benefits,
3. Project impact,
4. Stakeholder satisfaction, and
5. Future potential.

Appendix A contains the list of success criteria variables (questions).

Their model was selected for this study as it is based on the latest literature which is a superset of the success criteria from the leading researchers on project success.

Project success is the dependent variable in the research model.

2.2. Project management methodologies (PMMs)

Forty years ago, the first formal PMMs were set up by government agencies to control budget, plans, and quality (Packendorff, 1995). Two of the main topics on PMM research involve the context of standardized versus customized PMMs and the comprehensiveness of a PMM.

Literature is split on whether standardization, which implies little environmental context; customization, which implies context; or a combination of both, which implies some context lead to a higher chance of project success.

2.2.1. Standardization

A PMM and its processes have been referred to as organizational processes implying they have degrees of standardization (Curlee, 2008). "Owners" of project management practices often perceive projects as a means to attain corporate goals and therefore follow the path of corporate control and standardization (Packendorff, 1995). Project management offices (PMOs) are often focused on standardizing organizational PMM and project management per se (Hobbs et al., 2008).

2.2.2. Customization

Shenhar and Dvir (1996) were the first proponents of customization in showing that projects exhibit considerable variation, which, at that time, went against the literature trend which assumed all projects were fundamentally similar. In repeating Shenhar et al's mantra Wysocki (2011) stated that the often-used term "one size fits all" does not work in project management. This is supported by Payne and Turner (1999) who found that project managers often report better results when they can tailor procedures to the type and size of the project they are working on or the type of resource used on the project. Russo, and Stolterman noted that the most successful PMMs are those developed for the industry/organization which are aligned to the context factors (2002).

2.2.3. Combination of standardization and customization

A contingency approach was suggested by Milosevic and Patanakul (2005) where it made sense to standardize only parts of the PMM in an organization. Aubry et al. (2010) found that the more experienced PMOs were using methods derived from agile PMMs that allowed flexibility in the processes and PMM. Turner et al. (2010) noted that organizations vary in size and so do their PMM requirements.

The literature on PMMs is divided on whether standardized or highly customized PMMs are more effective in supporting project success, but the research implies the importance of

context albeit in varying degrees. In this paper, we look at the impact of context on the effectiveness of a PMM.

Independent of whether a PMM is standardized, customized, or a combination of both, when the organization's PMM is incomplete or is limited, the efficiency of the project will be impacted. Wells (2012) found that PMMs vary in completeness and appropriateness from organization to organization as some are considered inadequate for certain types of projects. White and Fortune (2002), using a survey on project management practices, reported that very few methods, tools, and techniques were used; and for the ones that were used, almost 50% of the respondents reported drawbacks to the way these were deployed. Fortune and White (2011) stated that 27% of respondents experienced limitations with in-house PMMs and 57% of respondents experienced limitations with other PMMs. These reported issues suggest it is not sufficient to look at the PMM as a whole, because every PMM is a heterogeneous collection of practices that vary from organization to organization (Harrington et al., 2012). A common understanding is required as to the elements (or parts) of a PMM, and their impact on project success. With this information, the issues reported on PMM limitations can be further investigated. We look at defining the elements of a PMM and determine their impact on project success in different contexts.

To understand what constitutes a PMM, several international standards were reviewed. The Project Management Institute (2013) describes a PMM as "a system of practices, techniques, and procedures, and rules," whereas Prince 2 from the UK is not described as a PMM, but rather as a method (Office of Government Commerce (OGC), 2002) that contains processes but not techniques.[2] Ericsson's PROPS PMM from Sweden, does not call itself a PMM but a model, where the model describes all of the project management activities and documentation (Ericsson, 2013). In absence of a consistent description for the elements of a PMM, this study uses the definition of PMM elements from Joslin and Müller (submitted for publication-b) which defines PMM elements as processes, tools, techniques, knowledge areas, and comprehensive capability profiles.

A PMM should take into account different levels of scope and comprehensiveness where the term comprehensiveness is taken to mean *including or dealing with all or nearly all elements or aspects of something*. PMMs that are not comprehensive are considered incomplete in this study and therefore will need to be supplemented during project execution.

Each organization must decide on the level of PMM comprehensiveness, where the more comprehensive the PMM, the less need for it to be supplemented when it is applied to a project. In this study, the term "organization's comprehensive PMM" means the implemented PMM within an organization and its ability to support all of the project types without the need to be supplemented with missing elements (Mengel et al., 2009, p. 33). Some organizations may choose not to invest in a comprehensive PMM or training and instead assume that their project PMM will always need to be supplemented, thereby leaving this decision to the user of the PMM. This is called "supplementing missing elements."

Irrespective of whether a PMM is supplemented or not, the user may still decide to apply only a subset of the PMM. This is done in an attempt to apply only those elements of a PMM required for achieving the desired project outcome. We refer to this as "applying relevant PMM elements" throughout the paper.

Studies showed that organizations experience limitations in their PMMs irrespective of whether it is an in-house or an off-the-shelf PMM (Fortune et al., 2011; White and Fortune, 2002). Wells (2013) found that when the selection of PMMs at the organizational level did not address the needs of the departments and projects, project managers would tailor their organizational PMMs specifically for their projects.

The literature review suggests the existence of a knowledge gap regarding the collective impact of a project's PMM elements on project success.

Hypothesis 1. There is a positive relationship between a PMM and project success.

H1.1. There is a positive relationship between a comprehensive set of PMM elements and project success.

H1.2. There is a positive relationship between supplementing missing PMM elements and project success.

H1.3. There is a positive relationship between applying relevant PMM elements and project success.

2.3. Project governance as a context factor

Governance influences people indirectly through the governed supervisor and directly through subtle forces in the organization (and society) in which they live and work (Foucault, 1980). Governance exists in every facet of life and interacts with laws and contextual frameworks, but it does not determine the actions of the members of a group or team (Clegg, 1994). There are various definitions of governance which vary in scope and focus, for example: governance of society, public governance, corporate governance, governance of projects, and project governance. Klakegg et al. (2009) define governance as "the use of institutions, structures of authority, and even collaboration to allocate resources and coordinate or control activity in society or the economy."

In projects, governance takes place at different levels, for example, groups of projects, such as programs or portfolios of projects, where the emphasis is on collective governance, which is viewed as governance of projects (Müller and Lecoeuvre, 2014). This differs from governance of individual projects, which we defined earlier in this paper using Pinto's (2014) definition.

The governance of projects combined with project governance coexist within the corporate governance framework, and both cover portfolio, program, and project management governance (Müller et al., 2014). The literature on project governance addresses several contexts, such as project governance for risk allocation (Abednego and Ogunlana, 2006), a framework for analyzing the development and delivery of large capital projects (Miller and Hobbs, 2005),

[2] The Office of Government Commerce (OCG) leaves it up to the project manager to decide on the relevant techniques to use during the project life cycle.

NASA-specific framework for projects (Shenhar et al., 2005), governing the project process (Winch, 2001), mechanisms of governance in project organizations (Turner and Keegan, 2001), normalization of deviance (Pinto, 2014), and governance in project-based organizations (functional, matrix, or projectized) (Müller et al., 2014). The literature on governance does not cover either the direct influence of governance on a project PMM or the impact of governance on the nature of the relationship between a project PMM and project success. Hence, there is a knowledge gap in the literature for understanding the impact of project governance on the nature of the relationship between a project PMM and project success.

The reason for considering project governance as the context factor is because corporate governance exists from the point of creation of an organization. Project governance has influenced the way individuals have viewed project management because it provides the structure through which projects are set up, run, and reported (Turner, 2006). Therefore, project governance is likely to influence the choices taken in selecting, applying, and evolving a PMM. Project governance may also influence the relationship between PMM and project success, which is one of the hypotheses in this paper. For these reasons, project governance was selected as the moderator variable factor for the research model (see Fig. 1).

To understand the impact of project governance on the relationship between PMM and project success, a framework to categorize each organization's governance is required. Governance models are developed from different perspectives using either a top-down or bottom-up approach (Klakegg et al., 2009). Top-down approaches are developed from a shareholder-outcome perspective whereas bottom-up approaches take a process control perspective and can be considered as an extension of a PMM (Müller, 2009). This study requires a governance model that considers perspectives of shareholder versus stakeholder, and a "follow the process" behavior approach versus a "get it done" outcome approach. This is required because the governance model perspectives map to the overall objective of a project, that is, a successful outcome, with the objective of a PMM (structured approach to deliver a project), all within an environment that is influenced by shareholders and stakeholders.

Governance models that incorporate topics such as ethics, corporate citizenship, roles, and responsibilities (Dinsmore and Rocha, 2012; Renz, 2008; Turner, 2008; Walker et al., 2008) were excluded because the emphasis of this study is on shareholder–stakeholder and behavior–outcome aspects of the organization. Therefore, the most relevant model was Müller's governance model (2009) which draws on the theories of transaction cost economics, agency theory, and institutional theory using legitimacy to emphasize conformance.

The governance model by Müller (2009) uses categories, called governance paradigms, where an organization governing a particular project fits into one of four paradigms. It addresses corporate governance orientation (shareholder–stakeholder orientation) and the organizational approach to control (behavior versus outcome control). The corporate governance dimension builds on models from Clarke (2004) and Hernandez (2012) who claim that a corporation's governance orientation can be found on a continuum from shareholder to stakeholder orientation. The second dimension "control" represents the control exercised by the governing institution over the project and its manager. This distinguishes between organizational control, which focuses on goal accomplishment by controlling outcomes (e.g., reaching a set of objectives), versus compliance with a focus on employees' behavior (e.g., following a process, such as a project management PMM) (Brown and Eisenhardt, 1997; Ouchi, 1980; Ouchi and Price, 1978).

To address the second part of the research question, based on the literature review we hypothesize that:

Hypotheses 2. The relationship between the project PMM and project success is moderated by project governance.

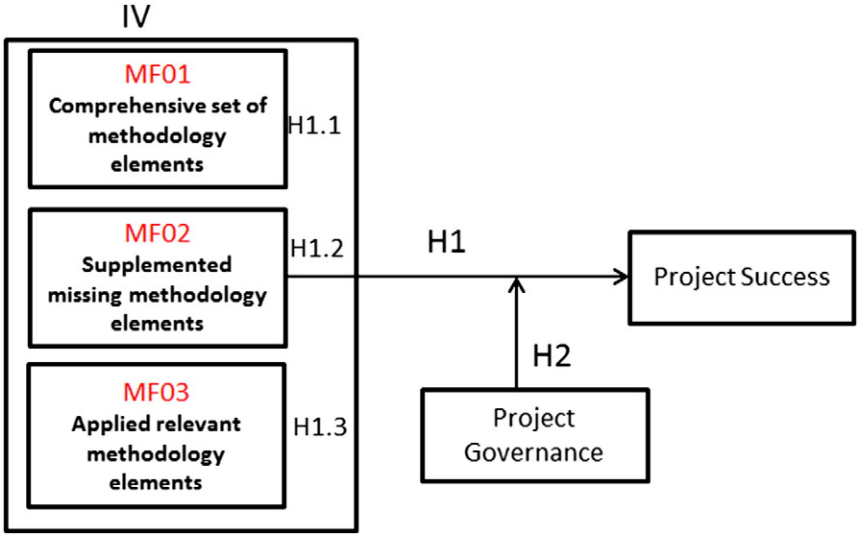

Fig. 1. Research model.

H2.1. The impact of a comprehensive set of PMM elements on project success is moderated by project governance.

H2.2. The impact of supplementing missing PMM elements on project success is moderated by project governance.

H2.3. The impact of application of relevant PMM elements on project success is moderated by project governance.

2.4. Contingency theory as a theoretical perspective

Contingency theory stresses the importance of idiosyncratic structures for organizations, depending on their context (Burns and Stalker, 1961; Woodward et al., 1965). We follow Donaldson's (2001) model of contingency theory in organizations, which explains the effect of one variable (an independent variable) on another variable (a dependent variable) as dependent on a third, a context variable.

A recent bibliographical review of contingency theory in the field of project management showed it is increasingly used in research with a noticeable increase since 2005 (Hanisch and Wald, 2012). Fitzgerald et al. (2002) noted that the most successful PMMs are those developed for industries or organizations that are aligned to context factors. Lehtonen and Martinsuo's study of project failure and the role of project management PMM concluded "some contingency variables may have an impact on the relation between PMM and success" (Lehtonen and Martinsuo, 2006). This supports the notion of contingency theory where the independent variable "PMM" and the dependent variable "success" are influenced by a third variable.

Contingency theory is being used as the theoretical lens for this study to help understand the impact of project PMM on project success in the context of governance paradigms.

3. Research methodology

We took a post-positivist perspective in the sense of Tashakkori and Teddlie (2009), who see post-positivism as 'currently the predominant philosophy for quantitative research in the human sciences' (p.69). Post-positivism 'assumes that the world is mainly driven by generalizable (natural) laws, but their application and results are often situational dependent. Post-positivist researchers therefore identify trends, that is, theories which hold in certain situations, but cannot be generalized (Biedenbach and Müller, 2011). Tashakkori and Teddlie (2009, p. 87) suggest that "post-positivists prefer using either quantitatively oriented experimental or survey research to assess relationships among variables and to explain those relationships statistically." This study uses a deductive approach and cross-sectional questionnaire to validate the model shown in Fig. 1.

3.1. Questionnaire development

Five sets of questions were included in the questionnaire. The first set included information about the last project; the next three sets covered project PMM, governance paradigms, and project success; and the last set collected the respondents' demographic information. The questionnaire development followed the suggestions of Cooper and Schindler (2011) to ensure the scales, criteria, and wording were consistent and clear. The questions relating to PMM were developed based on prior work by Joslin and Müller (submitted for publication-b). The PMM dimensions and questions are shown in Appendix B. The project context questions were based on the governance paradigms from Müller (2009), which were then operationalized in Müller and Lecoeuvre (2014). The governance paradigms were selected as they have been used successfully in several project management related studies and reflect an organization's governance positioning with regard to two continuums: (1) shareholder–stakeholder and (2) behavior–outcome. The project success dimensions were based on Khan and Turner (2013). The five dimensions (project efficiency, organizational benefits, project impact, stakeholder satisfaction, and future potential), cover short- and long-term implications of project success. A pilot test was done with ten respondents. Based on the feedback, minor wording changes were made for understandability. The pilot answers were not used in the analysis.

The recommendations from Podsakoff and Organ (1986) were followed to minimize potential common methods bias, including confirmed anonymity in the introductory text, different layout and scales, and randomizing of the questions. To avoid biases introduced by the respondent's choice of project, for example, providing information about their most successful project, the survey asked respondents to report on their most recently completed project.

3.2. Data collection

Data collection was performed through a worldwide, cross-sectional questionnaire to collect quantitative data for generalizable results. The respondents were contacted using email with a link to the web survey. In addition, the survey details were placed on project management LinkedIn forums. An email with the survey link was sent to PMI chapters. Data were collected in a period of 14 days in April 2014. The following filter question was asked to identify qualified respondents: "Do you have an understanding of your organization's or client's project PMM, where you have been involved as a project stakeholder, that is, someone working in or impacted by projects? By asking this question, 132 responses were disqualified. This resulted in 254 full responses that could be used for analysis. Responses came from 41 different countries with 24% from Europe, 38% from North America, 22% from Australasia, and 16% from other countries. ANOVA analyses on differences between the early and late respondents, as well as between demographic regions showed no significant differences ($p = 0.149$ and 0.249 respectively). Average work experience was 22 years and average project-related work experience was 15 years. Sample demographics are shown in Table 1.

The respondents' last project information is shown in Table 2. Approximately 48% of the projects were less than 1 million Euros and 96% of the projects were of medium to high

Table 1
Demographics.

Characteristic	N	%	Characteristic	N	%
Sector			*Gender*		
Research & development	31	12.2%	Male	194	76.4%
Engineering/construction	46	18.0%	Female	56	22.0%
Information technology/telecom	120	47.1%	Other	1	0.4%
Media/arts	9	3.5%	Total	251	98.8%
Relief aid	16	6.3%	Missing	3	1.2%
Other	29	11.4%			
Total	251	98.4%	*Geography — Working*		
Missing	4	1.6%	North America	96	37.8%
			Europe	61	24.0%
Position held			Australasia	56	22.0%
CIO	3	1.2%	Other	38	15.0%
CTO	2	0.8%	Total	251	98.8%
Project Portfolio manager	17	6.7%	Missing	3	1.2%
PMO	10	3.9%			
Program manager	65	25.6%	*Project related experience*		
Project manager	82	32.3%	1 to 5 years	36	14.6%
Team member	24	9.4%	6 to 10 years	63	25.6%
Architect/Advisor	6	2.4%	11 to 15 years	53	21.5%
QA/Audit function	3	1.2%	16 to 20 years	45	18.3%
Technical stakeholder	2	0.8%	20 years plus	46	18.7%
Business stakeholder	4	1.6%	Total	243	98.8%
Other	35	13.8%	Missing	3	1.2%
Total	253	99.6%			
Missing	1	0.4%	*Work experience*		
			1 to 5 years	36	14.6%
			6 to 10 years	60	24.4%
			11 to 15 years	46	18.7%
			16 to 20 years	49	19.9%
			20 years plus	52	21.1%
			Total	243	98.8%
			Missing	3	1.2%

urgency. 42% of projects were executed in matrix organizations and only 21% were executed in functional organizations.

3.3. Data analysis methods

Analysis was carried out following the guidelines from Hair et al. (2010). Data was checked for normality (skewness and kurtosis) within the limits of ±2 and ±3, respectively. Eight outliers were removed because one-sample tests showed these cases were significantly different from the other cases.

Exploratory factor analysis using principle component analysis was used on PMM, governance, and success variables to identify underlying structures and reduce the number of variables to a manageable size while retaining as much of the original information as possible (Field, 2009). Validity was tested through unrotated factor analysis for each dimension, which also served as the Haman test to exclude common method bias-related issues, as suggested by Podsakoff and Organ (1986). The results for each of the three concepts gave a Kaiser–Meyer–Olkin (KMO) sampling adequacy value of 0.8 or higher ($p < 0.001$), indicating the data's appropriateness for this analysis.

Following Sharma et al. (1981), hierarchical regression analysis was used to test the relationship between PMM and success (Hypothesis 1) and to test the moderating influence of governance on the relationship between PMM and success (Hypothesis 2). Finally, a number of ANOVA tests compared the means of three or more groups to determine additional information pertaining to two or more of the research model variables. The results are shown in the following sections.

Table 2
Last project information.

Characteristic	N	%	Characteristic	N	%
Duration of last project			*Urgency of last project*		
Under six months	44	17.3%	Low	11	4.3%
6 months to less than 1 year	67	26.4%	Medium	107	42.1%
1 to 2 years	76	29.9%	High	135	53.1%
Over 2 years	66	26.0%	Total	253	99.6%
Total	253	99.6%	Missing	1	0.4%
Missing	1	0.4%			
			Last project executed in the following organizational structure		
Level of last project complexity			Projectized organization	81	31.9%
Low	24	9.4%	Functional organization (department)	55	21.7%
Medium	117	46.1%	Matrix organization	106	41.7%
High	111	43.7%	Other	11	4.3%
Total	252	99.2%	Total	253	99.6%
Missing	2	0.8%	Missing	1	0.4%
Value of last project					
Under 500,000 (Euro)	85	33.5%			
500,000 to 999,999	37	14.6%			
1,000,000 to 4,999,999	61	24.0%			
5,000,000 to 50,000,000	43	16.9%			
Over 50,000,000	27	10.6%			
Total	253	99.6%			
Missing	1	0.4%			

"Years of project experience" was used as a control variable to filter out spurious effects and improve internal validity by reducing the confounding effect of variations in a third variable that could also affect the value of the dependent variable.

3.4. Validity and reliability

Construct validity was ensured through the use of published measurement dimensions (authors; Khan et al., 2013; Müller and Lecoeuvre, 2014); pilot testing of the questionnaire; and unrotated factor analyses. Content and face validity was achieved by using literature-based measurement dimensions and testing them during the pilot.

Item-to-item and item-to-total correlations below 0.3 and 0.5, respectively, showed internal consistency. Reliability was tested using Cronbach's alpha. All constructs showed reliability with their respective values over 0.70 (Hair et al, 2010).

3.5. Preparation for operationalization of variables

3.5.1. Project success

Factor analysis produced a single dimension and reliable factor for project success (KMO 0.930, $p < 0.001$) and a Cronbach's alpha of 0.923.

3.5.2. Methodology (PMM)

Operationalization was carried out by using a five-point Likert scale ranging from strongly disagree to strongly agree. The three factors "comprehensive set of methodology elements" labeled MF01-COMPREHENSIVE, "supplemented missing methodology elements" labeled MF03-SUPPLEMENTED, and "applied relevant methodology elements" labeled MF03-APPLIED were reliable at 0.75 to 0.77 (Hair et al., 2010) (see Table 3).

Factor analysis with Varimax rotation (eigenvalue > 1, KMO = 0.800, $p = 0.000$) on the methodology questions showed sampling adequacy (Field, 2009) as shown in Table 4. Four factors were originally identified, explaining 62% of the variance in methodology. However, the mix of loaded variables was impossible to interpret; therefore five, three, and two-factor solutions were tested, and the decision for a three-factor solution was taken because of interpretability (Hair et al., 2010). The factors were determined using a cut-off of 0.5 for loadings. A Haman test (Podsakoff and Organ, 1986) showed that all variables loaded on their predicted factor, thus no issues with common methods bias were detected.

3.5.3. Governance

Similar analyses were done for the governance questions. The data were adequate for factor analysis (normal assumptions met (KMO 0.812, $p < 0.001$). Principle component analysis with Varimax rotation at a cut-off Eigenvalue of 1.0 for factor acceptance (Field, 2009) resulted in two factors, which explained 53% of the variance: GOVCorpGov (shareholder versus stakeholder) and GOVCorp (behavior versus outcome control). Both were reliable at Cronbach alpha's of 0.743 and 0.802, respectively.

4. Results

4.1. Impact of PMM elements on project success

The correlation matrix (Table 5) indicates positive correlations between the variables, which provides for further analysis. Hierarchical regression analysis was performed using the previously mentioned control variable and the three independent variables for a comprehensive set of methodology elements (MF01), supplemented missing methodology elements (MF02), and applied relevant methodology elements (MF03) using project success as the dependent variable, with a significance level set at 0.05. Results are shown in Table 6 under Step 2. All independent variables correlate significantly with project success with an R^2 of 22.3%. Thus, giving support for Hypothesis 1 and its subhypotheses H1.1, H1.2, and H1.3.

4.2. Moderating effect of governance on the relationship between the elements of a PMM and project success

Following Sharma et al. (1981), a hierarchical regression analysis was carried out to test moderating influences of governance on the relationship between methodology and project success (hypothesis H2).

The results are shown in Tables 5 and 6. Variance inflation factors (VIF) with values under 2 indicate no issues of multicolinearity among the independent variables. The control variable (DEM06) had no significant effect on the dependent variable (project success). As stated above, MF01-

Table 3
Descriptives.

Measure	N	Mean	Standard deviation	Range	Original number of dimensions	Scale reliability (alpha)	Skewness	Kurtosis
Methodology								
Comprehensive set of methodology elements	246	3.39	3.56	5.11	1	0.747	−0.629	0.094
Supplemented missing methodology elements	246	3.77	3.182	6.76	1	0.774	−1.015	2.492
Applied relevant methodology elements	246	3.98	2.63	6.16	1	0.771	−0.320	1.189
Governance								
Shareholder–stakeholder	246	2.87	4.05	4.46	2	0.741	0.419	−0.462
Behavior–outcome	246	2.97	4.75	4.51	2	0.802	−0.203	−0.617
Project success	246	3.81	3.37	4.88	5	0.923	−0.720	0.552

Table 4
Rotated component matrix for methodology factors.

		Comprehensive set of methodology elements	Supplemented missing methodology elements	Applied relevant methodology elements
METH09	Comprehensive set of techniques	**0.809**	0.033	0.086
METH05	Comprehensive set tools	**0.783**	0.019	0.080
METH01	Comprehensive set processes	**0.762**	−0.002	0.017
METH17	Comprehensive set knowledge areas	**0.720**	−0.094	0.216
METH13	Comprehensive set cap-profiles	**0.665**	−0.002	0.163
METH06	Supplemented missing tools	−0.041	**0.769**	0.134
METH18	Supplemented missing knowledge areas	0.042	**0.713**	0.236
METH10	Supplemented missing techniques	−0.064	**0.688**	0.151
METH14	Supplemented missing cap-profiles	0.168	**0.664**	0.309
METH02	Supplemented missing processes	−0.098	**0.658**	0.080
METH11	Applied relevant techniques	0.099	0.139	**0.748**
METH07	Applied relevant tools	0.100	0.156	**0.730**
METH03	Applied relevant processes	0.057	0.125	**0.685**
METH19	Applied relevant knowledge areas	0.151	0.246	**0.631**
METH15	Applied relevant cap-profiles	0.270	0.373	**0.601**
	Cronbach's alpha	0.747	0.774	0.771
	Variance explained (5)	29.1	18.3	7.8

Extraction method: Principle component analysis.
Rotation method: Varimax with Kaiser normalization. Bold = loading above 0.5 cut-off level.

COMPREHENSIVE, MF03-SUPPLEMENTED, and MF03-APPLIED had a significant direct effect in step 2 of Table 6, with $R^2 = 22.3\%$.

The moderating variables GOVControl and GOVCorpGov were inserted in step 3 (see Table 6). GOVCorpGOV significantly correlates with project success. The interaction effect is tested in step 4 by inserting the product of independent variables and moderator variables. It shows that the interaction of MF03-APPLIED with GOVCorpGOV is significantly correlated with project success, thus a quasi-moderator (Sharma et al., 1981). However, the F for change in step 4 of Table 6 is not significant; therefore GOVCorpGOV can be considered as a quasi-moderator (Sharma et al., 1981).

The other governance dimension, GOVControl, does not interact with any of the independent variables but is related to MF01-COMPREHENSIVE and MF03-SUPPLEMENTED. Therefore, the visual binning was carried out for MF03-APPLIED by dividing the data into four groups to determine whether there is a significant difference between groups. The results showed no significant difference between the four bins (groups); therefore, according to Sharma et al. (1981), GOVcontrol is possibly an exogenous, predicator, intervening, antecedent, or a suppressor variable. This warrants further investigation.

4.3. Exploring the impact of project governance on a PMM

In an exploratory approach, we looked at the direct impact that project governance, more specifically GOVControl (behavior versus outcome), has on the use of PMM.

GOVControl was now the independent variable and was tested against MF01-COMPREHENSIVE (a comprehensive set of methodology elements, MF03-SUPPLEMENTED (supplemented missing methodology elements), and MF03-APPLIED (applied relevant methodology elements). The results showed that the relationship between GOVControl and MF01-COMPREHENSIVE was significant ($p <= 0.01$) with a beta of −0.163. This indicates that organizations that are more behavior/compliance-oriented are more likely to have a complete set of methodology elements. The second set of results showed that relationship between GOVControl and MF03-SUPPLEMENTED was significant ($p < 0.005$) with a beta of 0.184. This shows that organizations that are more outcome-oriented are more likely to supplement missing methodology elements, as required, than those that are more compliance-oriented who use a complete methodology. The third set of results showed that the relationship between GOVControl and MF03-APPLIED was insignificant, therefore GOVcontrol (behavior versus outcome) has no impact on how the methodology elements are used.

4.4. Other findings

We examined project success on the basis of demographics and additional methodology data. These tests were conducted using ANOVA to examine the difference between the means of different groups selected using demographic data. There were significant differences at where $p = 0.05$:

- Respondents who said they used PMMs designed for services had significantly higher project success rates than those that said PMMs were developed for products or both products and services.
- Respondents who said their PMM required a higher level of project management experience reported significantly higher project success rates.

Table 5
Correlation matrix.

	Project success REGR factor score 1 for analysis 1	Project work experience (years) DEM06	Comprehensive set of methodology elements MF01	Supplemented missing methodology elements MF02	Applied relevant methodology elements MF03	GOVControl governance "behavior–outcome orientation"	GOVCorpGoV corporate governance "shareholder–stakeholder orientation"	MF01 x GOVControl	MF02 x GOVControl	MF03 x GOVControl	MF01 x GOVCorpGov	MF02 x GOVCorpGov	MF03 x GOVCorpGov
Project success REGR factor score 1 for analysis 1	1.000												
DEM06 Project work experience (years)	−0.063	1.000											
Comprehensive set of methodology elements (MF01)	**0.196****	−0.094	1.000										
Supplemented missing methodology elements (MF02)	**0.168***	0.089	−0.002	1.000									
Applied relevant methodology elements (MF03)	**0.385****	0.059	−0.006	0.000	1.000								
GOVControl governance 'Behavior- > Outcome Orientation'	0.019	0.092	**−0.157****	**0.174*****	−0.073	1.000							
GOVCorpGoV corporate governance (Shareholder- > Stakeholder) Orientation	**0.270****	−0.050	0.090	−0.034	**0.104***	−0.013	1.000						
MF01xGOVControl	−0.009	**0.101***	0.026	0.066	−0.041	0.016	**0.116***	1.000					
MF02xGOVControl	0.041	0.023	0.061	**−0.357****	**0.116***	0.023	0.089	−0.076	1.000				
MF03xGOVControl	0.017	0.098	−0.045	**0.134***	−0.071	**0.110***	−0.051	−0.040	−0.009	1.000			
MF01xGOVCorpGov	0.036	**0.136***	**0.176*****	0.030	0.014	**0.109***	−0.080	**−0.233****	0.051	**0.105***	1.000		
MF02xGOVCorpGov	**0.139***	**0.135***	0.040	**0.227****	−0.012	**0.110***	**0.145****	0.074	−0.092	0.025	**−0.121***	1.000	
MF03xGOVCorpGov	**0.107***	0.043	0.018	−0.015	−0.077	−0.056	0.058	**0.127***	0.009	**0.137***	**−0.311****	**0.286****	1.000

*p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.005; ****p ≤ 0.001.

- Respondents who said they used an international PMM were significantly more likely to report that their methodology was comprehensive.

5. Discussion

The three independent factors (MF01-COMPREHENSIVE, MF03-SUPPLEMENTED, and MF03-APPLIED) represent completeness, supplementation, and application of the elements of a PMM, respectively. All three factors are significantly correlated to project success and 22.3% of the variation in project success can be explained by applying the relevant PMM elements (MF03-APPLIED) throughout the project life cycle.

The results support the findings of White and Fortune (2002) and Shenhar, Dvir et al. (2002a), Shenhar, Tishler et al. (2002b) and show that the experience of using a PMM and the correct choice of tools, techniques, and processes are both success factors.

The results show that one of the two moderator factors, GOVCorpGov, which is the shareholder versus stakeholder continuum, acts as a quasi-moderator. This means it has an indeterminate impact on the relationship between applied methodology elements (MF03-APPLIED) and project success, because in this constellation "each of the independent variables can, in turn, be interpreted as a moderator" itself (Cohen, 1988, p. 294). The other two independent variables, comprehensive set of methodology elements (MF01-COMPREHENSIVE) and supplemented methodology elements (MF03-SUPPLEMENTED), are not moderated by either of the two moderator factors.

From this point, the study turns from deductive to exploratory as we look to see if there is a direct relationship between the other moderator variable (GOVCorp) and the independent variables (MF01-COMPREHENSIVE to MF03-APPLIED). We find a significant relationship with the independent variable, comprehensive set of methodology elements (MF01-COMPREHENSIVE), and also the supplemented methodology elements (MF03-SUPPLEMENTED). This implies that governance not only acts as a quasi-moderator (GOVCorpGov) between the applied PMM and project success, but it also may influence the development or selection of the PMM, whether it is comprehensive or not. If an organization is more behavior-oriented, then the incumbent PMM is more likely to be enhanced over time, thereby not requiring supplementation by the project manager. However, for organizations that are more outcome-oriented, there is a likelihood that the PMM will not be complete and will require supplementation by the project manager. This may be a deliberate intention to allow the project manager to tailor the PMM for the project needs.

Contingency theory within the field of project management offers insight into how to best adapt project management practices within a given environment to meet the project management goals (Donaldson, 2006; Müller et al., 2012; Turner et al., 2009; Wheelwright and Clark, 1992). A PMM's completeness is contingent on governance and suggests that

Table 6
Hierarchical regression with PMM as independent variables, project success as dependent variable, and governance as moderator variable.

Variables entered	Dependent variable project success ($N = 243$)			
	Step 1	Step 2	Step 3	Step 4
Control variable				
Project work experience	−0.063	−0.084	−0.078	−0.086
Main effect IV on DV				
MF01: Comprehensive set of methodology elements		0.191 ****	0.180 ***	0.171 ***
MF02: Supplemented missing methodology elements		0.176 ***	0.173 ***	0.176 ***
MF03:Applied relevant methodology elements		0.391 ****	0.372 ****	0.380 ****
Moderators				
GOVControl (governance control orientation) (1)			0.055	0.051
GOVCorpGov (corporate governance orientation) (2)			0.218 ****	0.208 ****
Interaction terms				
MF01 x (1)				−0.036
MF02 x (1)				0.030
MF03 x (1)				0.018
MF01 x (2)				0.028
MF02 x (2)				0.045
MF03 x (2)				0.128 *
F for regression	0.974	17.060 ****	14.724 ****	8.004 ****
F for change	0.974	22.335 ****	8,035 ****	1.207
R-square	0.004	0.223	0.272	0.295

Main table contains standard coefficient betas VIF <2.
**$p \leq 0.01$.
* $p \leq 0.05$.
*** $p \leq 0.005$.
**** $p \leq 0.001$.

using contingency theory as a theoretical lens supports the premise that PMMs are impacted by context.

Additional findings suggest project success is more correlated to stakeholder-oriented than shareholder-oriented organizations. Project success is also associated with organizations that have comprehensive PMMs versus organizations with incomplete PMMs. The findings also show that more experienced project managers are needed to effectively apply both comprehensive PMMs and PMMs that need to be supplemented.

6. Conclusions

This study is the second part of a mixed-methods study that investigates the effect of governance on the relationship between a PMM and project success using a contingency theory perspective. A deductive approach validated a theoretically derived research model. The data were collected through a web-based questionnaire with 246 respondents from six industry sectors evenly distributed across North America, Europe, and Australasia. PMM impact on project success was analyzed, including the quasi-moderating effect of governance on this relationship.

The two research questions can now be answered. For the first question, we found that there is a positive relationship between PMM and project success. Regarding project success, 22.3% of the variation is accounted for by the PMM, supporting Hypothesis 1. H1.1 is supported whereby having a comprehensive set of PMM elements including tools, techniques, process capability profiles, and knowledge areas (MF01-COMPREHENSIVE) is linked to project success. Also project PMMs that are comprehensive have higher success rates than PMMs that need to be supplemented; but supplementing with PMM elements (MF03-SUPPLEMENTED) is also linked to success, therefore, H1.2 is supported. Applying the relevant PMM elements (MF03-APPLIED) is also positively correlated with success, supporting H1.3.

For the second research question—project governance as a moderator on the relationship between PMM and success—we observed one of the two moderating factors GOVCorpGov (shareholder–stakeholder) acting as a quasi-moderator and not as a full moderator. The role of the second proposed moderator, GOVControl (behavior–outcome), was also indeterminable because results indicate that it can be either an exogenous, predicator, intervening, antecedent, or suppressor variable (Sharma et al., 1981). Therefore Hypothesis 2 is only partly supported and need further investigation.

Several researchers (Fortune and White, 2006; Shenhar et al., 2002b) show that it is not the use of a PMM that leads to project success; it is the experience of using a project PMM and the ability to tailor it to the context of a project links to project success. The results of this study indicate the importance of having a comprehensive PMM and the experience to tailor a PMM are two success factors in the context of the organizational environment. Therefore, the understanding of the organization's governance paradigm is part of the contextual positioning of how to apply the PMM.

After testing the research model, the study switched from confirmatory to exploratory research to understand whether governance has a direct impact on a project PMM. The findings suggest that project governance may also influence the selection of a PMM and how it evolves. For example, when an organization is more behavior oriented, the findings show that an organization's PMM is more likely to be comprehensive. The opposite is true for organizations that are more outcome oriented. Therefore, organizations that make a decision to develop their own PMM or adopt an international standard will have different starting points as well as different paths to whether and how their PMM evolves depending on their governance paradigm.

6.1. Practical implications

All project managers should have access to a comprehensive PMM with the experience to know which of the PMM elements to apply to any given project, and if required, supplement missing PMM elements, because collectively they account for 22.3% of the variation in project success.

A manager responsible for several projects who knows the governance paradigms and their implications on current and future projects may help influence, shift, or create local project governance paradigms that are more conducive to success. Organizations that have a more comprehensive PMM need experienced project managers to ensure they achieve high success rates. By understanding the governance paradigm and state of the evolution of the organization's PMM, a program or project portfolio manager will have insight into the project management skills and especially the experience necessary for a successful project outcome. When project success rates are dropping and lessons learned indicate the possibility of an unsuitable PMM, understanding the governance paradigms and the risks associated with the evolution of a PMM within each governance paradigm may provide valuable information as to the root cause of the problems.

6.2. Theoretical implications

The study provided several new insights that can inform further theory development. First, PMM can now be added as a success factor to the project success literature, as it stands for 22.3% of the project's success. This constitutes a major effect of practical significance (Cohen, 1988). Second, the study showed the importance of distinguishing between the presence of and use of PMMs. The presence of PMMs in form of comprehensiveness (MF01-COMPREHENSIVE) or the need for supplementation (MF03-SUPPLEMENTED) carry less weight than the application of a PMM (MF03-APPLIED) in the success equation. Accordingly, further research on project success needs to take this difference into account by being observant of the application of PMM (or other success factors) and not its mere presence. This warrants further investigation for other nonhuman-related project success factors, such as the

presence versus the use of mission statements, plans, or schedules, to name a few. The results of these studies potentially change our understanding of success factors to a large extent. Third, the selection of a project PMM and its evolution is influenced by governance. As with PMM elements, a distinction between presence and application prevails in governance. Behavior-controlled organizations prefer comprehensive PMMs and outcome-controlled organizations prefer supplementable PMMs when being successful. However, it should be noted that application is not influenced by governance. Related theoretical implications are that governance is mainly confined to the procedural aspects such as form selections and provisions of PMMs, but does not influence the project manager's behavior in terms of the appropriate usage thereof. Again, the project manager's work appears to be decoupled from the procedures and processes provided to him or her, which should be investigated further.

6.3. Further research

Future research could provide insights into determining the effectiveness of a PMM and its elements in achieving project success by evaluating:

- Are there other moderating or mediating factors that influence the relationship between project PMM and project success?
- Which factors influence an organization to develop its own PMM or adopt a certain type of PMM and how do these factors influence how a PMM evolves within the organization?

6.4. Strengths and limitations

One of the strengths of this study is the sample and its balance between the three main regions of the world. Another strength is the targeting of professionals who are engaged in professional organizations, which led to better responses, because these respondents are interested in their profession over and above their employer's demands. This strength also comes at the cost of a limitation. The use of professional associations such as IPMA and PMI for the distribution of the questionnaire limited the pool of respondents to only their members. A second limitation lies in the exploratory results of some of the findings, which requires further study for validation. Another limitation is that it is unclear whether the respondents last project was completed recently or say five years ago which may influence their responses to the questionaire.

6.5. Contributions to knowledge

This paper contributes to the understanding that the effectiveness of a PMM is not only determined by the manner in which it is applied, but in the way organizational governance paradigms influence the selection and evolution of a PMM.

The effectiveness of a PMM that contributes to project success is influenced potentially by many factors where governance directly impacts a PMM but is only a quasi-moderating factor in the relationship between PMM and project success.

PMMs need to continually evolve by adapting to the organizational environment within the governance paradigm; otherwise these PMMs will be misaligned with the project contexts and hence reduce their contribution to project success.

Conflict of interests

The authors declare that there is no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

Appendix A. Project success questions

The following success-related questions were asked regarding the last project.

Project success achieved					
My last project was successful in terms of:					
	Not successful	Slightly successful	Moderately successful	Highly successful	Very highly successful
Completed according to the specification	○	○	○	○	○
Supplier satisfied	○	○	○	○	○
Enabling of other project work in future	○	○	○	○	○
Project achieved a high national profile	○	○	○	○	○
Yielded business and other benefits	○	○	○	○	○
Met client's requirement	○	○	○	○	○
Minimum disruption to organization	○	○	○	○	○
Cost effectiveness of work	○	○	○	○	○
Met planned quality standard	○	○	○	○	○
Adhered to defined procedures	○	○	○	○	○
Learned from project	○	○	○	○	○
Smooth handover of project outputs	○	○	○	○	○
	○	○	○	○	○

(continued on next page)

Appendix A. (*continued*)

Project success achieved					
My last project was successful in terms of:					
	Not successful	Slightly successful	Moderately successful	Highly successful	Very highly successful
Resources mobilized and used as planned	○	○	○	○	○
Improvement in organizational capability	○	○	○	○	○
Met safety standards	○	○	○	○	○
Minimum number of agreed scope changes	○	○	○	○	○
Motivated for future projects	○	○	○	○	○
Project's impacts on beneficiaries are visible	○	○	○	○	○
Project achieved its purpose	○	○	○	○	○
Project has good reputation	○	○	○	○	○
Finished on time	○	○	○	○	○
New understanding/ knowledge gained	○	○	○	○	○
Steering group satisfaction	○	○	○	○	○
Complied with environmental regulations	○	○	○	○	○
End-user satisfaction	○	○	○	○	○
Project team satisfaction	○	○	○	○	○
Activities carried out as scheduled	○	○	○	○	○
Finished within budget	○	○	○	○	○
Sponsor satisfaction	○	○	○	○	○
End product used as planned	○	○	○	○	○
Personal financial rewards	○	○	○	○	○
Met organizational objectives	○	○	○	○	○
The project satisfies the needs of users	○	○	○	○	○
Personal nonfinancial rewards	○	○	○	○	○

Appendix B. PMM dimensions and questions

The following questions were asked for PMM-related questions on a 5-point Likert scale ranging from strongly disagree, to strong agree.

In my last project…

Comprehensive PMM	The organization's project PMM had a comprehensive set of tools
	The organization's project PMM had a comprehensive set of techniques
	The organization's project PMM had a comprehensive set of capability profiles
	The organization's project PMM had a comprehensive set of knowledge areas
	The organization's project PMM had a comprehensive set of processes
Supplemented PMM	I supplemented the organization's project PMM when necessary, with missing tool(s)
	I supplemented the organization's project PMM when necessary, with missing technique(s)
	I supplemented the organization's project PMM when necessary, with capability profiles(s)
	I supplemented the organization's project PMM when necessary, with missing knowledge areas(s)
	I supplemented the organization's project PMM when necessary, with missing process(es)
Applied relevant PMM elements	I applied the relevant tools during the project life cycle
	I applied the relevant techniques during the project life cycle
	I applied the relevant capability profiles during the project life cycle
	I applied the relevant knowledge areas during the project life cycle
	I applied the relevant processes during the project life cycle
Achieved expected results	I achieved the project results expected by applying relevant tools
	I achieved the project results expected by applying relevant techniques
	I achieved the project results expected by applying relevant capability profiles
	I achieved the project results expected by applying relevant knowledge areas
	I achieved the project results expected by applying relevant processes

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