PAPERS

Contextualized Project Management Practice: A Cluster Analysis of Practices and Best Practices

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ABSTRACT

The specificity of project management in different contexts and industries is recognized, but little empirical research encompasses a sufficiently broad range of contexts and project types to precisely identify these specificities. This article adopts such a wide perspective based on a large sample of data from an ongoing empirical investigation of project management practice. Contextual archetypes are identified (i.e., clusters of experienced practitioners that share similar organizational and project contexts). Archetypes of contextualized practice are then investigated through the study of the extent of use of empirically identified toolsets in each cluster. The results empirically confirm some well-known assumptions about practice but also sharpen the knowledge and understanding of practice in real complex multidimensional contexts. A new concept of "performing-maturity" emerged from the data. This concept sheds light on the entangled imbrications of maturity, competence, and success. Practices are regressed against performing-maturity to reveal best contextualized practices.

KEYWORDS: project management practices; performance; maturity; context; cluster analysis; empirical survey research

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INTRODUCTION

Project management is practiced in many different contexts, each with its particular management problems. Considering the wide variety of contexts and situations facing the millions of practitioners engaged in project endeavors, the project management paradigm is surprisingly well defined through generic bodies of knowledge such as the Project Management Institute's *PMBOK® Guide* (PMI, 2008a) and the Association for Project Management's *APMBoK* (APM, 2006).

The idea that project management practice varies from one context to another is widely accepted. The *PMBOK® Guide* recognizes the "need for determining what is appropriate for any given project" (PMI, 2008a, p. 4) but does not provide guidance as to how this choice might be made. In addition, there has been enough empirical research to validate the idea of the contextual variability of practice and to provide some examples of how practice varies in different contexts. The literature review provides examples of this research. However, most research to date has provided only a partial picture because in each study the set of practices and/or the number of different contexts that have been examined have been limited. This article adopts a wider perspective based on a large sample of data from an ongoing empirical investigation of project management practice, which has accumulated approximately 2,500 respondents—experienced practitioners working in widely diverse contexts. A subsample of 1,296 practitioners from widely diverse backgrounds participating in a large-scale international survey is used for this article.

The research objectives are both empirical and theoretical. Three of the limitations of the project management bodies of knowledge are that they lack empirical foundation, are inventories of practices but provide little indication of the relative importance of the diverse practices or the structure that might underlie them, and indicate that practice must be adapted to the context but do not provide indications of what this adaptation might be. The research reported here aims to contribute to these current shortcomings in the literature generally and in standards specifically. The empirical component of this research provides insights into both the nature of project management practice and its contextual variation. The clusters of contextualized practice identified may form the basis of theoretical developments.

The first research question, "Can typical multidimensional contexts in which practitioners performed their work be identified (i.e., contextual archetypes)?" is addressed using cluster analysis. The analysis uses a set of variables measuring elements of organizational and project contexts to identify typical multidimensional contexts.

The second question, “What are the project management practices in these multidimensional contexts and how do these patterns of practice vary between contextual archetypes?” is addressed by examining the practices within each cluster (i.e., a practice archetype within a context archetype or “an archetype of contextualized practice”) and by making comparisons among them.

The analysis of practice is further pursued using a new concept that emerged from the data, the concept of performing-maturity. The analysis bypasses the unsettled issue of the causal relationships between maturity, competence, and success by integrating them in an enhanced maturity construct. The concept is presented in more detail later. The third question, “Which project management practices can be categorized as ‘best practices’ in each archetype of contextualized practice?” is addressed by regressing practices against performing-maturity in each contextual archetype.

Literature Review

This research investigates the practices, tools, and management techniques that are specific to project management. Project managers may use tools and practices from different management disciplines, but the development of the field of project management justifies research that focuses on the specificity of their practice.

Within the project management literature, the vast majority of the research on practices focuses primarily on small and specific groups of practices. Several studies compare a larger number of practices but most often in a specific context. Zwikael (2009), Williams (2007), Yang, O’Connor, and Wang (2006), Zwikael and Globerson (2006), Winch and Kelsey (2005), McMahon and Lane (2001), Raz and Michael (2001), Zeitoun (1998), Hargrave and Singley (1998), and Thamhain (1998) focused on a specific application area, process group, knowledge area, or particular aspect of practice. Therefore, most of the research on practice does not allow for comparative evaluation of the relative use of the whole body of practices. There have been few studies examining differences in project management practice between industries, project types, and contexts. Those studies tend to examine only a limited range of practices inspired by the seminal work of Pinto and Slevin (1987) and Pinto and Covin (1989). Very few adopt a wider view and attempt to identify general use and usefulness of large numbers of project management practices (Besner & Hobbs, 2006, 2008a, 2008b; Milosevic, 2003; Papke-Shields, Beise, & Quan, 2010; Thomas & Mullaly, 2008; White & Fortune, 2002).

Besner and Hobbs (2012) were able to empirically identify toolsets using principal component analysis on the same large dataset. They further examined differences in toolset use between project types. The present article allows identification of archetypes of practices in a more holistic contextual perspective. Contextual influences are not examined one by one but as a whole situation modeling professional practice. These models of practices can be conceptualized as strategic decisions to build an asset in terms of project management capabilities harmonized with the organizational environment.

Data

The cluster and regression analyses upon which this article is based require that each respondent in the sample have responded to each and every question so that there are no missing data. This is a very stringent requirement when the number of questions is large, as is the case here. A sample of 744 responses meeting this requirement was used for the cluster and regression analyses. The clustering algorithm grouped these responses into five distinct clusters. This number proved to be sufficient to identify many statistically significant differences.

More than a hundred practices, tools, and techniques that are specific to project management have been identified. This set of practices, tools, and techniques has been identified from a detailed examination of a number of sources, including the *PMBOK® Guide* (PMI, 2008a), Max Wideman’s glossary (2006), and several articles published in the *Project Management Journal* and the *International Journal of Project Management*. In contrast with other research, general concepts and processes (e.g., training programs, performance measurement) have been excluded from this research. The practices, tools, and techniques selected for this research are more specific and closer to day-to-day practice, closer to the things people regularly do. This involves a partial view of project management practice; it restricts the investigation to those well-known tools and techniques that are specific to project management. However, doing so ensures that the practitioners participating in the study easily understand the questionnaire. In addition, because the objective of this research is to study practice, a quantifiable measure of practice is derived by limiting the survey to the use of specific practices and tools. For each practice, tool, or technique, the respondents answered the following question using a 5-point Likert scale: “How extensively do you use this tool or technique?”

The questionnaires also collected demographic data on respondents (position, education, experience, etc.), and contextual data on their organizations (geographic region, size, industry, project management maturity, etc.) and on their projects (size, complexity, etc.). These variables allow for an assessment of how project management practices vary according to organizational and project contexts. The fact that the sample is split evenly for many of these variables renders the analysis easier and more reliable. Data was collected through a web-based questionnaire with support from the PMI Research Department, several chapters of PMI,

Toolset Name	Use	Alpha
Initial planning	3.27	0.82
Project closure	2.95	0.77
Basic project management software functionality	2.95	0.88
Business case definition	2.94	0.79
Bid and fixed-price contracts	2.81	0.80
Progress monitoring	2.76	0.76
Baseline change management	2.72	0.79
Financial evaluation	2.71	0.76
Project analysis	2.71	0.64
Risk management	2.68	0.90
Team management	2.37	0.75
Multiproject management	2.32	0.86
Network planning	2.13	0.78
Business benefits measures	2.12	0.79
Databases	2.10	0.84
Variable price contract	1.96	0.62
Advanced project management software functionality	1.91	0.86

Table 1: The list of toolsets.

and colleagues in universities around the world.

The respondents of the present research are mostly between 30 and 50 years old (71.6%). Their current primary role and the average number of years of experience in this role are as follows: team member (9%; 8 years), project manager (50%; 8 years); program manager/director (31%; 5 years); other (12%; 6 years). Considering that 85% of the respondents declare experience in at least two of these categories, they appear well qualified to provide valuable information based on their practical experience. The total average experience of the respondents in program director, project manager, and team member roles is 16.2 years.

An analysis reported in Besner and Hobbs (2012) empirically identified 19 project management toolsets: practices, tools, and techniques that tend to be used in groups. Considering the very stringent requirement described above, only 17 toolsets could be used in the analyses presented in this article; they are presented in Table 1 in decreasing order of their average level of use. As can be seen from the table, the average level of use varies among the toolsets. The Cronbach's alphas for each toolset are also presented in Table 1. The composition of each toolset can be found in the Appendix.

Analysis

The analysis is presented in four steps:

1. Identification of constructs: "performing-maturity," "organization size," "project size," and "complexity";
2. Identification of "contextual archetypes";
3. Identification of significant differences in practice among the contextual archetypes; and
4. Identification of best practices.

Step 3 is followed by a discussion of the results for each cluster and comparisons between clusters. Step 4 is followed by a discussion of the overall results and a conclusion.

Step 1: Identification of Constructs

The database of this study contains a large number of contextual variables. A principal component analysis (PCA) procedure was applied in order to reduce data by identifying underlying constructs that might summarize some of the contextual variables and thus reduce their number. The first component identified was "performing-maturity," a factor based on four variables:

1. The level of project management maturity of the organization (measured on the well-known CMMI scale);
2. The level of support for the use of tools and techniques provided by the organization (training, procedures, instructions, templates);
3. The availability of competent project personnel; and
4. The respondents' perceived rate of project success of their organizations compared with competitors' organizations in the same sector of activity. This global measure of success was revealed to be quite robust by Cooper, Edgett, and Kleinschmidt (2004).

A confirmatory factor analysis (CFA) was used to verify this result. The Cronbach's alpha of 0.69 verified the reliability, while the CFA verified the convergent validity. According to Hair, Anderson, Tatham, and Black (1998), a Cronbach's alpha measure of more than 0.60 is acceptable in exploratory research such as this. The average variance extracted by the CFA is greater than 40% (p 0.000) and all the t-values are significant (p 0.001), which is within the acceptable threshold when investigating a new concept (Brady & Cronin, 2001; Fornell & Larcker, 1981).

The factor loadings indicate that performing-maturity is first and foremost a maturity construct. They approximately follow the correlation coefficients in Figure 1 showing that the maturity variable is strongly related to the support variable; both of these variables measure organization process development. Maturity and support are less strongly related to the two other items: competence and success. Others have proposed constructs involving maturity; Skulmoski (2001), Hartman and Skulmoski (1998), and Frame (1999) suggested an integrated model combining project management competency and maturity.

Project management maturity is a concept widely used in the project

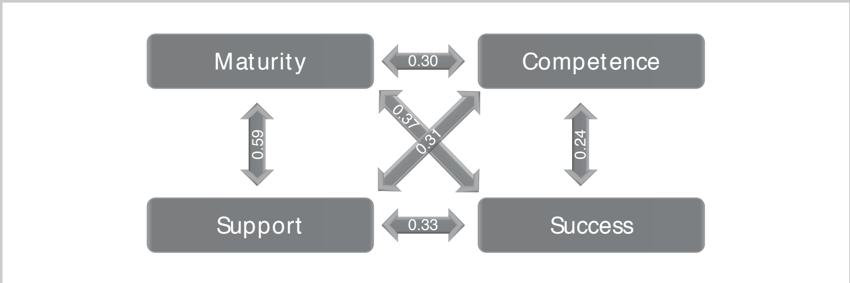

Figure 1: The performing-maturity factor.

management community among practitioners, professional associations, and researchers (PMI, 2008b). The concept is modeled on the Software Engineering Institute's Capability Maturity Model scale in five levels. The concept of maturity is based on the systematic use of project management processes that are materialized through the use of tools, techniques, and practices. It is, therefore, almost by definition that more mature organizations use the tools, techniques, and practices more often. In addition to more frequent use, the concept of maturity is based on the concept of more consistent and better managed use of tools, techniques, and practices. Maturity is associated with a common organization-wide understanding and the use of project management processes; a fully mature organization focuses on continuous improvement of these processes with the aim of improving project management effectiveness. The level of project management maturity is widely used as a metric for project management excellence. It is a synthesis of many aspects of practice.

There has been a debate in the project management community concerning the relationship between maturity and success (Thomas & Mullaly, 2008). The correlation between maturity and success shown in Figure 1 only explains approximately 14% of the variance. While this is significant, many other factors influence success. The purpose of the present study is not to prove such a relationship; it is instead to identify contextual variability in practice and best practice. The use of the performing-maturity construct sidesteps the challenge of demonstrating the cause-and-effect relationships between competence, support, maturity, and success.

The present research purposely adopts a very wide exploratory stance to reach its goal. The performing-maturity construct must therefore be considered as an exploratory result that needs to be substantiated by more research. Each of the items composing performing-maturity could be considered as a construct in itself. For the purpose of identifying best practice, performing-maturity can be regarded as an approximate measure of a "successful, mature, and supportive organization." It has been shown to be useful both as a means of differentiating among the contextual archetypes and as a dependent variable for identifying best practices.

In addition to performing-maturity, the PCA identified two other factors that could be used to reduce the number of context variables. These are "organization size," which is composed of the number of employees and the number of project managers (alpha 0.68), and "project size," which is composed of project budget and duration (alpha 0.61). Because the Cronbach's alphas are above the value identified by Hair et al. (1998) and because they are very intuitive and conceptually consistent, they are used in the analyses that follow.

Two variables included in the study can be conceptually considered as measures of complexity: number of disciplines involved and number of project interfaces. These were not identified as a factor by the PCA. They were used to create a construct that is labeled "complexity" in the analyses that follow.

The fact that the PCA was not able to group most of the contextual variables into factors is an indication that these are independent dimensions of the contextual space. With many independent dimensions, many combinations are possible, and it is difficult to know how the dimensions will interact. Cluster analysis is therefore the appropriate technique for identifying constellations of respondents.

Step 2: Identification of Contextual Archetypes

A cluster analysis was performed using organizational and project context variables to identify clusters of practitioners differentiated by their working environment or "contextual archetypes." The SPSS TwoStep™ cluster component handles both continuous and categorical variables (SPSS, 2001). This procedure was also developed to help identify the optimal number of clusters. The result of the TwoStep procedure, the relative cluster size, and the clusters' interpretability strongly suggested clustering data in five distinct groups of practitioners. The five clusters of practitioners are presented in Table 2. Each cluster represents a group of practitioners that works in a similar environment referred to as a "contextual archetype."

The scores for each cluster on each dimension represent the average for practitioners in the cluster. Only the scales for the first seven contextual variables reporting the percentage of responses within each contextual archetype are meaningful. The other scales are not meaningful; they cannot be interpreted as percentages.

Because of unequal variance, a global comparison using the Kruskal-Wallis Test was used to confirm differentiation across the five clusters (p 0.0000). Cluster interpretation is supported by pairwise comparisons

Cluster	C1		C2		C3		C4		C5	
Contextual variables used to identify the clusters	***N*** **147**	**D**	***N*** **175**	**D**	***N*** **163**	**D**	***N*** **114**	**D**	***N*** **145**	**D**
Percentage of projects in business and financial services	0.129		0.171		0.203		0.132		0.200	
Percentage of projects in engineering and construction	0.054		0.069		0.497	4	0.000	4	0.090	
Percentage of projects in IT and telecom	0.612		0.703		0.000	4	0.860	4	0.641	
Percentage of projects in software development	0.204	3	0.057		0.301	4	0.009	4	0.069	
Percentage of organizations in the private sector	0.980		1.000	3	0.841		1.000	3	0.000	4
Percentage of international projects	0.497		0.480		0.448		0.518		0.186	4
Percentage of internal projects	0.776	4	0.400		0.000	4	0.237	3	0.648	3
Organizational size (organization # employees and project managers)	0.266	3	0.073		−0.185	4	0.182		0.001	
Project size (budget and duration)	0.374	4	0.199		0.408	4	0.122		0.038	
Level of project definition	0.640		0.000	4	0.614		1.000	4	0.435	3
Degree of complexity	0.327	4	0.737	3	0.644		0.754	3	0.566	
Degree of innovation	2.333	3	2.686	3	2.478		2.684	3	2.365	
Degree of similarity of projects	0.952	4	0.377	4	0.785	3	0.518		0.538	
Contextual variables NOT used to identify the clusters										
Projectized structure	2.810		2.954		3.221	3	3.298	4	2.545	4
Percentage of participation in initiation/concept phase	0.497		0.554		0.564		0.588		0.469	3
Number of phases in which the practitioner is involved	2.612		2.646		2.730		2.860	3	2.290	4
Performing maturity	0.084		0.256	3	0.053		0.410	4	0.199	3

Table 2: Clusters of practitoners with differentiated contexts or "contextual archetypes."

between clusters. Because there are five clusters, 10 pairwise tests are necessary to provide comparisons for each pair. Because of unequal variance, a non-parametric Mann-Whitney Test was chosen to identify significant differences between clusters.

The organizational and project context variables that are used in the cluster analysis are presented in the top section of Table 2. The four variables in the bottom section are all related to project practice in some way and were not used in the analysis to identify the clusters or contextual archetypes. The performing-maturity variable identified in the previous step was not used to identify the clusters. Excluding performing-maturity from the cluster analysis enables additional analyses related to the association between this measure of performance and variations in both context and practice, in the entire sample and in each cluster. The three additional variables considered to be in the practice realm are two variables measuring the involvement of the practitioners in different phases of the project and one variable measuring the type of organizational structure.

With 10 pairwise comparisons per context variable and 19 variables, there are 190 pairwise comparisons. Table 2 summarizes the pairwise comparisons in the columns labeled "D" for the number of significant differences at the level p 0.10 (80% of the differences are at p 0.01). The "D" scores identify the clusters that have a score significantly higher (4 or 3) or lower (4 or 3) than three or four other clusters for each context variable. Please note that the context score for a specific cluster can be significantly higher than two clusters and at the same time significantly lower than two other clusters, but these cases are not shown in the columns labeled "D" in Table 2. Some clusters are seen to contrast strongly on some context variables. The distributions of practitioners working on different types of deliverables, the first four lines of Table 2, show very different distributions among the archetypes. Note that a greater proportion of a context in a cluster compared to the other clusters is possible independently of whether the majority of the practitioners in all clusters work in the same context or not. For example, no cluster shows a majority of practitioners working on software development projects (line 4), but in two clusters the proportion is significantly higher and in one it is significantly lower.

IT and telecom projects (line 3) are by far the most common type of project in the overall sample. They are also the most common type of project in four archetypes. However, no IT and telecom projects are part of C3. The interpretation of the results for four archetypes needs to consider that IT and telecom projects dominate in these archetypes but are totally absent from C3. Almost all the engineering and construction projects are in C3, which is also the only archetype with no internal projects; the others have varying proportions of internal and external projects. In yet another example of highly differentiated distributions, line 5 shows that all clusters but C5 are composed exclusively or almost exclusively of practitioners working in private organizations, but the last cluster has all its respondents working in the public sector. These discriminating characteristics are exploited to interpret the results in the section that follows presenting the contextual archetypes.

Step 3: Identification of Significant Differences in Practice Among the Contextual Archetypes

The main focus of this ongoing study is practice, a reality check of what project management practitioners really do. Following the identification of archetypes from the differences in the contexts in which they work, Table 3 presents the differences in practice found in each. The first column of Table 3 lists the toolsets in decreasing order of average use in the overall sample, while the other columns show the extent of use of each toolset in the contextual archetypes. Again, the columns labeled "D" indicate the cases where three or four significant differences were noted with other clusters. These results are per se a valuable finding because they provide evidence of the variation of practice among different multidimensional contexts.

Within each cluster the toolsets are, not entirely, but largely, in decreasing order. This means that toolsets that are used more extensively on the average tend to be used more extensively in most if not all clusters. The same is true for toolsets that are used less extensively.

A significant positive difference in the use of a particular toolset does not mean that all practitioners of this cluster use the particular toolset every day. A positive significant difference can occur for a seldom-used toolset, meaning that it is used more extensively but still used infrequently. For example, the least-used toolset on average is advanced project management software, for which there are several significant differences in use but the level of use remains low for all clusters. Interpretation of these results is pursued in the next section.

Presentation of Contextual Archetypes

The research has identified multidimensional contextual archetypes from a cluster analysis. Table 2 presents a summary of the analysis for each cluster and identifies the main contrasts between clusters. The graphical representation of the contextual archetypes in Figures 2 and 3 also includes the average level of use of all toolsets from Table 3.

Figure 2 is structured according to two main axes. The horizontal axis is labeled "smaller internal projects in larger organization vs. larger external projects in smaller organization." It is important to note that the average organization and project sizes are not small. The median organization size is approximately 2,000 employees, and the median project cost and duration are near US$1,000,000 and nine months. The vertical axis is defined by high and low scores on three variables: performing-maturity, well-defined projects, and average level of use of all toolsets. All of the archetypes are exclusively or almost exclusively in the private sector, except C5, which is exclusively in the public sector.

For all five contextual archetypes, the scores for performing-maturity, project definition, and average use of toolsets form a consistent pattern. C4 and C2 occupy extreme positions. C1 and C3 are in the middle on this dimension. C5 is in the same position as C2 except on project definition, for which it occupies a position above C2 and below both C1 and C3. The three variables that are the basis of this axis are conceptually reinforcing. They are also correlated (performing-maturity with average use, 0.325, p 0.0000, performing-maturity with well-defined, 0.307, p 0.0000, average use with well-defined, 0.213, p 0.0000). More mature organizations use all the toolsets more extensively almost by definition. The link between performing-maturity and level of use of all toolsets and the level of project definition can be interpreted in two different ways. It may be that project management tools and practices help produce better defined projects. It may also be that project management tools and practices are better adapted to well-defined projects. The associations are consistent with either of these two explanations.

Cluster Toolsets	All	C1 N 147	D	C2 N 175	D	C3 N 163	D	C4 N 114	D	C5 N 145	D
Initial planning	3.27	3.33	3	3.09	4	3.16		3.63	4	3.17	
Project closure	2.95	2.95		2.84		2.93		3.24	4	2.75	3
Basic project management software functionality	2.95	3.01		2.87		2.95		3.28	4	2.79	
Business case definition	2.94	3.01		2.86		2.73	4	3.32	4	2.95	
Bid and fixed-price contracts	2.81	2.48	4	2.68		3.11	3	3.04	3	2.79	
Progress monitoring	2.76	2.78		2.63		2.68		3.09	4	2.71	
Baseline change management	2.72	2.82		2.51	3	2.74		3.07	4	2.58	
Financial evaluation	2.71	2.73	3	2.52		2.49		2.95	4	2.50	
Project analysis	2.71	2.74		2.55	3	2.69		2.98	4	2.61	
Risk management	2.68	2.66		2.58		2.52		2.98	4	2.65	
Team management	2.37	2.42		2.30		2.27		2.71	4	2.19	
Multiproject management	2.32	2.47		2.16		2.26		2.48	3	2.24	
Network planning	2.13	2.10		2.00		2.14		2.35	4	1.97	
Business benefits measures	2.12	2.17	3	1.98		1.99		2.46	4	1.94	
Databases	2.10	2.06		1.92		2.14		2.28	4	1.87	3
Variable price contract	1.96	1.84		1.88		2.09	3	2.18	3	1.85	
Advanced project management software functionality	1.91	2.00		1.84		1.87		2.09	3	1.77	
Means	**2.60**	**2.62**		**2.48**		**2.56**		**2.88**	**4**	**2.49**	

Table 3: Significant differences in practice among the contextual archetypes.

The scores for project size and for the distinction between projects for internal vs. external customers also form a consistent pattern for all five contextual archetypes. The variables project size and internal vs. external project customers do not form as natural an association as the variables upon which the vertical axis is based; the variables project size and internal vs. external are not correlated. This is an illustration of patterns that the multidimensional cluster analysis can identify that cannot be identified by examining the relationships among variables in pairs using bivariant analyses. The contextual archetypes identified by the cluster analysis constitute complex multidimensional sets of practitioners that are not readily identifiable from direct observation or simple analysis.

Project and organizational size are both correlated with higher average level of use of toolsets (respectively 0.139, p 0.0000 and 0.131, p 0.0000) while the nature of the project customer as internal or external is not. C1 is characterized by small projects in large organizations and C3 by large projects in small organizations. The opposing associations of C1 and C3 with project and organizational size neutralize the effects on toolset use in these clusters. This is another illustration of the complex nature of the contextual archetypes and the nature of project management practice that is found in each. Each of the contextual archetypes is examined in more detail in the following subsections. The order of presentation highlights the contrasting pairs C4 with C2 and C1 with C3. C5 is discussed last.

C4: More Performing-Maturity, Better-Defined Projects, and Greater Use of Tools

The differences between this contextual archetype and all the others are statistically significant on all three variables that define the vertical axis: performing-maturity, well-defined projects, and average use of toolsets. Table 3 shows the differences in use of toolsets; all are used more in C4 than in the majority of other archetypes, but with no obvious pattern of differentiated use. It should be recalled that the

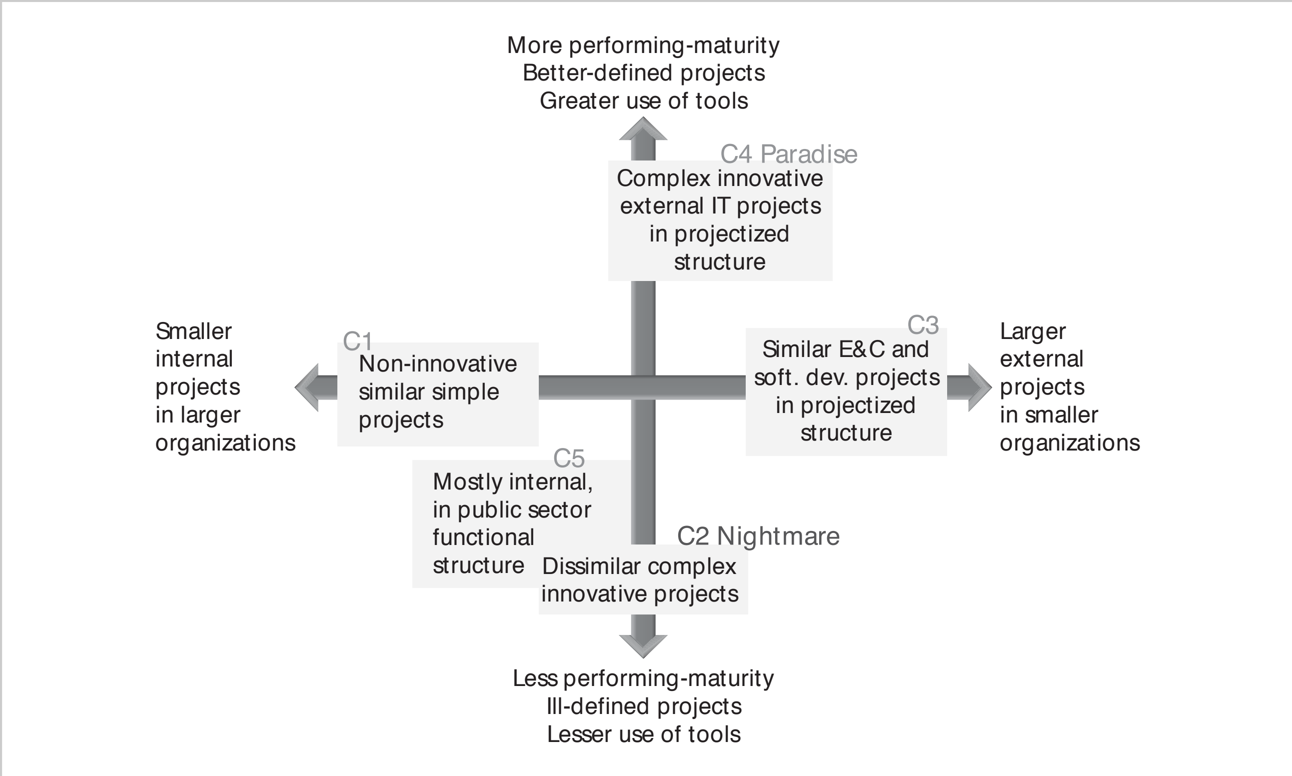

Figure 2: A graphic representation of the five contextual archetypes.

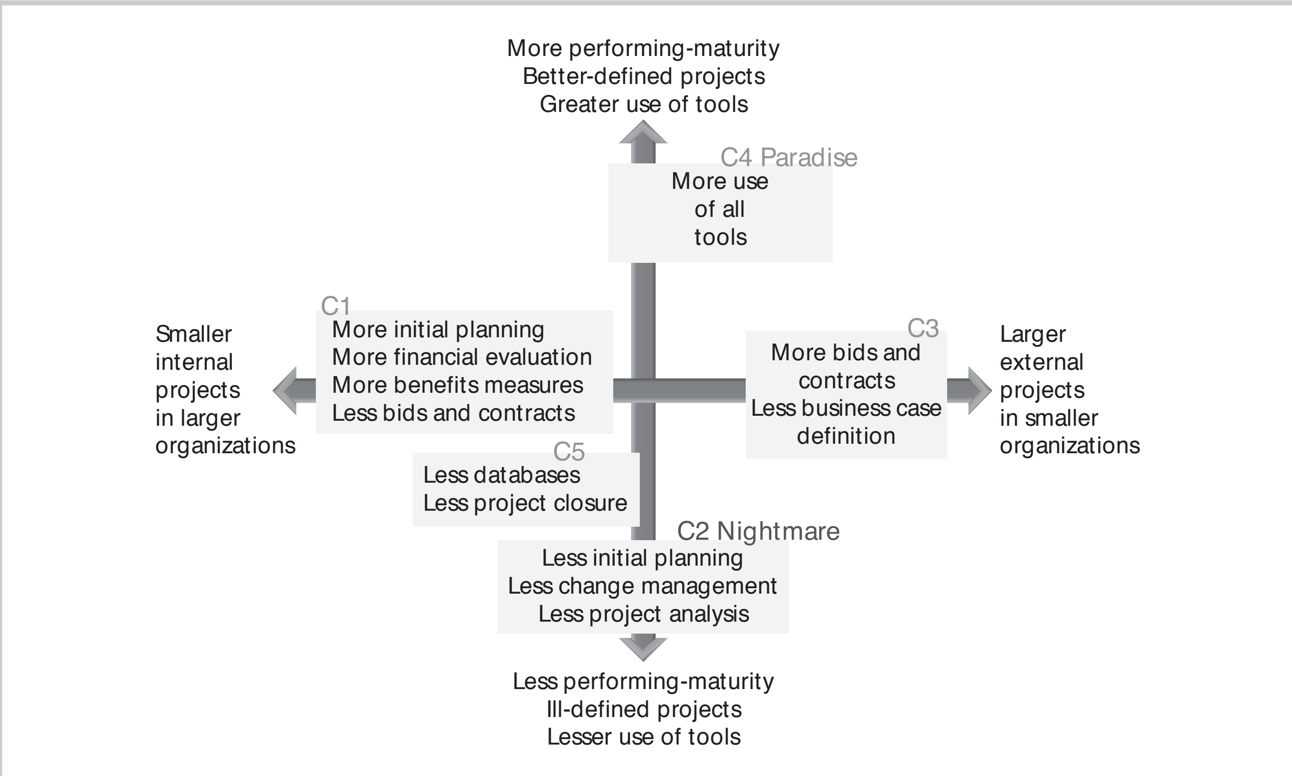

Figure 3: A graphic representation of the practices within the five contextual archetypes.

performing-maturity construct is composed of project management maturity, organizational support for the use of project management tools and techniques, the availability of competent project personnel, and project success. Organizations in C4 also have structures that are more projectized than all other archetypes. Projects in this archetype are likely to be better integrated across project phases, because practitioners in this archetype are involved in more project phases than in all other archetypes except C3, which also has a projectized structure. This context might be considered "project paradise." Everything is well aligned to support project management practice and performance. This is the traditional project management paradigm at its best.

The types of projects in this context are quite specific. As in all archetypes except C3, the majority of projects are in IT and telecom. However, the proportion is significantly higher in C4 compared to all other archetypes (86%). However, only a minority of IT projects (24%) are found in such a favorable context. The fact that the projects are well defined is a particular aspect of the context that limits the domains in which this very advantageous situation may occur. An examination of the other characteristics on which this context differs helps to better understand in which contexts "project paradise" is likely to develop. Almost all the remaining projects in C4 are business and financial service projects (13%). Less than 1% of projects are of other types. In other words, engineering and construction and software development projects are very rarely found in this favorable context.

The majority of projects in the entire sample (58%) are for external customers. The proportion of external projects in C4 is 76%, which is significantly greater than all other archetypes, except C3, in which all the projects are for external customers, but this represents only 14% of all external projects in the sample. The project characteristics of complexity and innovativeness are correlated (0.214, p 0.0000). The projects in the archetypes C4 and C2, which occupy the extreme positions on the vertical axes, show the same significantly higher levels for both. The relationships between project practice and both complexity and innovativeness are complex; innovativeness is not correlated with performing-maturity or level of project definition; it is, however, correlated with the use of most toolsets. It is not the complexity or the innovativeness of projects in C4 that differentiates them from those in C2, but their higher level of definition.

An examination of the variables on which C4 is not distinct from most other archetypes also facilitates understanding. C4 is not significantly different from most other archetypes with respect to the proportions of business and financial service projects and international projects, organization size, project size, and similarity of projects. Some of the characteristics that define this contextual archetype are as clear as "black and white": 100% private firms, with well-defined projects and 0% engineering and construction projects and almost no software development projects. Other characteristics are a question of proportions that are greater or less than those found in other archetypes.

C2: Less Performing-Maturity, Ill-Defined Projects, and Less Use of Tools

C2 contrasts with C4 on all the variables that compose the vertical axis. C2 has a significantly lower score for performing-maturity than all three of the other archetypes in private firms. It has a lower level than C5, the public sector archetype, but the difference is not statistically significant. It also shares the lowest score for average use with the public sector archetype. It is very distinctive in that 100% of its projects are ill defined; no other archetype has a majority of ill-defined projects. It is also very distinct in that it has significantly more projects that are dissimilar than all other archetypes. It shares with C4 the complex and innovative nature of its projects. If C4 represents "project paradise," then C2 represents "project nightmare," characterized by managing dissimilar, ill-defined, complex, and innovative projects in a context with low project management maturity, low levels of use of project management tools and techniques, low levels of support for the use of project management practices, a lack of availability of competent personnel, and poor project performance. The causal relationships among these characteristics are unclear. It may be that the traditional project management paradigm is ill adapted to this context. Alternatively, it may be that the ill-defined nature of the projects is explained by the lack of application of the traditional project management paradigm. The lack of use of traditional project management methods cannot, however, explain the dissimilar nature of projects; using more tools would not make projects more similar. This cluster in particular may need to develop and adopt new practices and tools better adapted to the challenging, highly uncertain, ill-defined environment it represents.

Table 3 reveals that three toolsets are used significantly less than in most other archetypes. The lower level of use of the project analysis and the initial planning toolsets on these ill-defined, dissimilar, complex, and innovative projects is somewhat paradoxical. From the perspective of the traditional project management paradigm, these would seem to be important toolsets to use in managing these types of projects in order to arrive at a better understanding and a better definition of project requirements. Here again the causal relationships are unclear; is it because the toolsets are not used that the projects are ill defined or is it because the traditional project management tools are poorly adapted to use on these projects that they are uncertain, difficult to manage, and perform poorly? In any case, the toolset for baseline change management, the third toolset significantly used less in this cluster, is almost impossible to use extensively in such a context with little initial planning and analysis.

Interestingly, this contextual archetype is not significantly different from a majority of other archetypes on many dimensions of context; it is not different on the proportions of any of the four project types found in this sample or the proportion of international projects, nor on organization or project size. The occurrences of this unfavorable context are therefore spread across the project landscape with respect to all of these contextual variables. It does, however, share the characteristics of low performing-maturity and low average use of project management practices with the public sector archetype C5 to which the discussion returns at the end of this section.

C1 vs. C3: Smaller Internal Projects in Large Organizations vs. Larger External Projects in Smaller Organizations

As was already discussed, C1 and C3 show similar midrange average levels of use of toolsets, due at least in part to the counterbalancing influence of project and organization size. They also show midrange values for performing-maturity and project definition. These are, however, the only clusters that show differential use of toolsets, meaning that some toolsets are used significantly more than in other contextual archetypes and some are used less, as shown in Table 3. This is discussed in more detail below following the examination of the other characteristics of these two contextual archetypes.

In addition to being characterized by small internal projects in large organizations, C1 is characterized by projects that are significantly less complex than projects in all other clusters and significantly less innovative than those in all the other archetypes in the private sector.

C3 is characterized by large external projects in smaller organizations. The types of projects found in the archetype are distinctive. There is a significantly larger proportion of engineering and construction projects than in all other archetypes; 50% of projects are of this type, which represents 62% of all engineering and construction projects in the sample. In all other archetypes, less than 10% of projects are of this type. In addition, there are no IT and telecom projects in C3, while in all other archetypes they represent more than 60% of the cluster's projects. In addition, C3 has a more projectized structure than all other archetypes except C4, which has a significantly even more projectized structure.

The projects in C1 and C3 contrast with those in all three other archetypes in that they are significantly more similar and the proportion of software development projects is higher. However, the projects in C1 are significantly more similar than those in C3. And the proportion of software development projects is significantly higher in C3 than in C1. These two archetypes, therefore, are distinct from all the others and from each other on these two characteristics.

The challenges of managing projects in contexts C1 and C3 are very different. Managing a large number of small internal projects is probably as challenging as planning and controlling larger external projects. However, the nature of the challenges and the project management practices that are put in place to manage them are very different. Table 3 shows that some specific toolsets are used significantly more in C1 and C3 and that others are used less. The practitioners of C1 doing small internal simple and similar projects are doing more initial planning, financial evaluation, and business benefits measurement when managing their projects. The initial planning toolset is the most extensively used toolset of all and is composed of well-known basic planning tools (see the Appendix). These basic tools are particularly well adapted to planning large numbers of small, simple, and similar projects. The financial evaluation and business benefits measurement toolsets are used to evaluate expected and realized benefits of projects and are used to make selection and evaluation decisions among the many small projects found in C1. Evaluation of projects to ensure that the endeavors are feasible and beneficial for the organization is critical when managing large numbers of internal projects.

Contract-related toolsets are used significantly less with internal projects than with external projects. C1 and C3, therefore, show contrasting levels of use, with C3 making greater use of the two toolsets related to contracts. C3 is also differentiated from all other contextual archetypes by less extensive use of business case definition. The large external projects of this cluster are selected, defined, and initiated by the client, and the business case is often not the responsibility of the supplier organization; the practitioners of C3 are answering requests for proposals from their clients. This produces a consistent archetype of not-so-large private engineering and construction or software development organizations with projectized structures doing large projects for external customers that develop their own business case and prespecify requirements.

C5: Public Sector, Functional Structure, Mostly Internal Projects

There is a general recognition that public sector administration is different from the management of private firms and that important differences exist in the practice of project management in each sector; there are many colleges and university programs around the world that specifically address public sector administration, and PMI (2008c) has published an extension of the *PMBOK® Guide* for the public sector. The identification of the archetype C5 confirms this differentiating dimension of project context. As an illustration of one of their specific characteristics, public bodies have constituencies to which they deliver services, which are most often national, regional, or local. Only a small number of public bodies are in the international domain; therefore, their projects are predominantly national, regional, or local, and very few are international. This is the only contextual archetype that does not have a very large proportion of international projects.

The public bodies found in this contextual archetype have more functional structures than all the other archetypes, which is consistent with the way many such organizations are structured. The survey upon which this study is based asked practitioners in which project phase or phases they are involved. The practitioners in C5 are involved in fewer phases than those in all the other private archetypes. This captures the effect of the functional silos found in many public bodies and their effect on the management of projects. This division of labor allows people to be specialized in some aspects of the management of projects but makes project integration and the creation of an overview more difficult.

In Figure 2, this public sector archetype is situated close to C2 but slightly higher and to the left in the direction of C1. On the vertical axis, it is very close to C2, labeled "less performing-maturity, ill-defined projects, and less use of tools." On performing-maturity, C5 has a higher score than C2, but the difference is not significant. Its projects are, however, significantly better defined than those in C2 but significantly less well defined than all other archetypes. On the use of toolsets, the scores for C2 and C5 are almost identical and are significantly lower than all the other archetypes. In conclusion, therefore, C5 is very close to C2 on the vertical axis except that its projects are better defined. This is not surprising because public bodies, with the possible exception of space agencies and large equipment procurement organizations, are generally perceived as less mature in project management and as poor project performers. The fact that projects are poorly defined but not as radically poorly defined as in C2 is consistent with the bureaucratic culture of public bodies that seek to reduce ambiguity, although not always very successfully.

On the horizontal axis of Figure 2, C5 is located centrally with C4 and C2 but closer to C1, the large organizations with smaller projects and internal customers. The public archetype C5 has significantly more internal projects than all other clusters except C1, and the difference with C1 is significant. The projects of public bodies in C5 are mostly internal because of the nature of their role in society. However, 35% of projects in the public archetype C5 are for external customers; these may be public agencies doing projects for other public agencies. In terms of the size of both the projects and the organizations in the archetypes C2, C4, and C5 are significantly smaller than those in C3 and significantly bigger than those in C1. Overall, the position of C5 is identical to that of C2 on Figure 2 except that its projects are better defined and the proportion of internal projects is higher.

The archetypes C2 and C5 have the lowest average level of use of project management toolsets. As previously discussed, performing-maturity is in part by definition linked to a greater use of project management practices and tools. This is coherent with the results of Table 3, which shows the significant differences among the clusters of practitioners regarding their practice. Clusters 2 and 5 are the only ones in which no toolsets are found to be used more while some are used significantly less.

The two toolsets that are used significantly less in the public archetype C5 are the project closure and the database toolsets. The lack of use of the project closure toolset indicates that these organizations put less emphasis on the closure of their projects than other archetypes, which is not surprising in their functional silos managing ill-defined projects. The lower level of use of databases may reflect a lack of investment in project management and a lack of integration across the project life cycle. The lower level of use of these two toolsets is not the dominant feature of project management in C5; their practice of project management is immature. A wider adoption of the traditional project management paradigm may be difficult to achieve in the bureaucratic functional silos of public bodies and may entail a significant change in their organizational cultures. This is not to say that all public bodies are in this situation; 16% of the organizations in C3 are also public.

The following sections present the final step in the analysis.

Step 4: Identification of Best Practices

The first three steps of the analysis and the presentation of the five archetypes have identified and described the reality of project management in different contexts. The final step of the analysis enriches these descriptions but goes beyond description; it addresses the question as to which practices are associated with higher performing-maturity: "What are the best practices?" Step 4 addresses this question for the overall sample and within each contextual archetype.

There is no consensus about the meaning of the expression "best practices" (Delisle & Olson, 2004). There is, therefore, much confusion in the literature and standards. Dictionaries and encyclopedias usually describe best practices as "recognized" methods or processes associated with "proven" results "over time" ("Best practices," 2011). The ISO organization has adopted the expression in its standards to describe recommended practices. PMI uses the expression "generally recognized as good practice" practices "applicable to most projects most of the time" (Project Management Institute, 2008a, p. 4). Chapman (2006) considers that the good practices described in the *PMBOK® Guide* are in fact "common practice," which he contrasts to "best practices," making a clear distinction between what is usually done and what could be done much better. The previous sections have contributed to a better identification of common and contextualized practices as they are found in reality. The objective of this section is to identify project management best practices.

A linear regression is used to identify best practices. The performing-maturity construct introduced in step 2 is used as the dependent variable. Table 4 shows the result of a standard linear stepwise regression of all the practice and context variables. The practice variables are the 17 toolsets and two additional variables considered to be in the practice realm (one variable measuring the involvement in the front-end phase of the project and one variable measuring the type of organization structure). The results are shown in Table 4 in which only those independent variables that form part of the regression models are shown. The list of practices is ordered by the T value of the regression on the overall sample shown in the first column. The "R" column indicates the variable rank within each cluster based on the T-statistic values. The adjusted R^2 is presented at the top of each column indicating the percentage of variance explained by the model. The regression models for the five contextual archetypes are presented using the same format. Note that only 12 of 17 toolsets are present in the regression model for the overall sample. Note also that one variable is included in the model for C2 that was not part of the model for the overall sample.

The question addressed by the regression analysis is different from the questions addressed in the previous steps of the analysis; the question here is not what characterizes the practice but what practices differentiate between high and low performing-maturity or what practices "explain" performing-maturity. How extensively a practice is used is not necessarily related to how well it differentiates high and low performing-maturity.

Four toolsets were not part of any of the regression models: financial evaluation, network planning, and the two contract-related toolsets. These toolsets are not in the list because variations in the intensity of their use do not differentiate between higher and lower scores for performing-maturity. Table 4 provides an image of "best practices" in the field of project management. Note that no toolset is a best practice in all archetypes. However, the regressions show that for the overall sample and for at least three of the five contextual archetypes the intensity of use of five toolsets are associated with higher scores for performing-maturity: (1) initial planning, (2) maintaining databases, (3) business case definition, (4) baseline change management, and (5) team management. To some extent, these may be considered "general best practices" appropriate in most contexts. Table 3 shows that initial planning is the most extensively used toolset in all the contextual archetypes and that business case development is also among the most extensively used toolsets. Despite their generally high level of use, those that use them more than the average obtain better results for performing-maturity in most contexts. This may seem paradoxical, but it highlights the very central role of these toolsets in project practice as well as their central role in best project practice. Establishing the business case and doing the initial planning are both done early in the project life cycle. Baseline change management is used somewhat less extensively, but its level of use also differentiates scores for performing-maturity. Having a good initial plan is, of course, a prerequisite for managing against a baseline. Baseline change management deals with the rigorous control of changes to the project after they have been approved, which is critical to good project management and performance. The team management toolset, the fifth of the "general best practices," is related to soft skills and tools that depart from the traditional "hard" project management toolsets. The human dimension is certainly a key to reaching performing-maturity in many contexts.

The use of databases, which is also one of the five "general best practices," is among the least used toolsets, but those that do use databases more achieve better scores for performing-maturity in all the private contextual archetypes. The use of databases requires significant commitment of resources by the organization; the individual practitioner cannot easily develop and maintain such tools. This explains their infrequent use (Besner & Hobbs, 2006). But organizations that invest in this toolset perform better on performing-maturity. Note that organizational support is one of the items of the performing-maturity construct.

Table 4 also shows that the remaining practices are best practices in some specific contexts but not in most. The following subsections examine each contextual archetype in more detail.

C1: Smaller Internal Projects in Larger Organizations. Use of databases is ranked first in explaining performing-maturity. Using databases seems logical to manage many small similar projects in large organizations that can support such investments. The databases for lessons learned have synergies with project closure, which includes lessons learned/postmortem. Practitioners focusing more on the toolsets used to develop and plan projects at the outset using initial planning and business case definition toolsets and on project closure score higher on performing-maturity in the entire sample and in this archetype. It can be a challenge to implement strong matrix and projectized structures in large organizations, but in C1 adopting these structures is associated with higher scores for performing-maturity. Note that baseline change management and team management are two of the five "general best practices" but are not identified as best practices in this context. This may be less critical for the smaller and shorter-duration projects

Cluster					C1			C2			C3			C4			C5	
Adj. R^2		All			N 147			N 175			N 163			N 114			N 145	
(p 0.000)		0.335			0.274			0.309			0.368			0.187			0.376	
Practices	T	prob.	R	T	prob.	R	T	prob.	R	T	prob.	R	T	prob.	R	T	prob.	R
Initial planning	6.5	0.000	1	2.5	0.015	4	3.1	0.002	3	4.8	0.000	1						
Databases	6.5	0.000	2	5.5	0.000	1	3.8	0.000	2	2.4	0.016	8	4.6	0.000	1			
Business case definition	6.4	0.000	3	2.1	0.039	5				3.7	0.000	2				4.5	0.000	2
Project closure	5.2	0.000	4	3.0	0.004	2										5.6	0.000	1
Baseline change management	4.8	0.000	5				2.3	0.021	7	3.0	0.003	5				2.8	0.006	3
Team management	4.8	0.000	6				2.1	0.034	8				2.3	0.022	2	2.7	0.007	4
Multiproject management	4.2	0.000	7							3.3	0.001	3						
Projectized structure	3.9	0.000	8	2.6	0.012	3										2.3	0.021	5
Basic PM software	3.5	0.001	9				3.9	0.000	1	2.6	0.010	7						
Advanced PM software	3.4	0.001	10							3.3	0.001	4						
Monitoring progress	3.3	0.001	11							2.7	0.007	6						
Project analysis	2.8	0.006	12				3.0	0.004	4									
Business benefits measures	2.4	0.016	13															
Participation in initiation/concept phase	2.1	0.036	14				2.5	0.015	6									
Risk management							2.6	0.009	5									

Table 4: Regressions of the practices on performing-maturity for the overall sample and for each cluster.

found in this context. This does not mean that they are not used or that they are not important; it means that variations in their use within this archetype are not associated with variations in the scores for performing-maturity. The best practices in this context explain 27% of the variance in performing-maturity.

C2: Less Performing-Maturity, Ill-Defined Projects, and Less Use of Tools. This was referred to as "project nightmare" in the description. In this context, several practices lead to better performing-maturity, and the percentage of variance explained is 31%. Use of databases is again among the strongest determinants of performing-maturity, but this time it must be much more challenging considering the ill-defined and dissimilar projects of this cluster.

Basic project management software, initial planning, and project analysis toolsets are related to planning and analyzing the difficult projects found in this context. Table 3 shows that the initial planning and project analysis toolsets are used significantly less in this contextual archetype, but both are practices that differentiate for performing-maturity within this context. There is a marked contrast between actual practice and best practice. On ill-defined dissimilar projects the initial analysis and planning are therefore particularly important; the use of specialized software contributes to this analysis and planning effort. The fact that it is done less may be an indication that it is more difficult or that the lower level of performing-maturity depicts an organization culture that does not support these practices. Whatever the reason, it would seem that poor choices are being made regarding the relative extent of use of these toolsets.

A greater participation in the front-end phase of the project is a best practice in "project nightmare." The most important analysis and initial plans are done during the front-end of the project. If the wrong direction or no clear direction is taken during the early definition phase, it is always difficult to get the project back on track. When the project manager is involved more during the front-end initiation/concept phase the project should be better defined at the outset. Finally, the use of risk management as a performing-maturity driver in this most uncertain cluster of all is consistent.

Returning to the remaining general best practices in the top section of Table 4, it is interesting to note that baseline change management is used less in this context as shown in Table 3 but is a discriminating best practice as well. Good planning is a prerequisite of good control of changes to the baseline; therefore, it is consistent that both are best practices in this context where both are less present. The last variable explaining performing-maturity in this cluster is team management; it is probably a difficult task to maintain moral and team cohesiveness in "nightmare," but it is certainly important. The other general best practice, business case definition, does not differentiate as a better practice in this context but is used at a level similar to those found in other archetypes. The fact that business case definition is not a differentiating best practice is a bit surprising given the importance of project analysis and initial planning in this context.

C3: Larger External Projects in Smaller Organizations. This is a context within which initial planning is the strongest driver of performing-maturity. Note that business case definition is used significantly less in this archetype than in the four others, but still business case definition is second ranked in predicting performing-maturity in this context. The fact that external customers often prepare their own business case before calling upon a supplier to execute the project can explain the less extensive use of this toolset by these suppliers. However, those that are involved in business case definition score higher on performing-maturity. It could be that when the supplier participates with the customer in defining the business case, results are better. It could also be that suppliers that score higher on performing-maturity invest in validating the customer's business case. It could also be that they produce their own business case. Databases are again a best practice in this context but are ranked last and therefore have less explanatory power.

The fact that baseline change management is critical on large engineering and construction and software development projects is not at all surprising given the nature of these projects. Two of the toolsets that are best practices only in this context are monitoring progress and advanced project management software. Basic project management software is also a best practice here. The traditional and the more sophisticated tools for project planning, monitoring, and control were developed for this type of project, and it is on these projects that they produce the most value, as shown by the fact that they are best practices here but not elsewhere, which does not mean that they are not used elsewhere but that their use is less critical to performance.

One other best practice that is specific to this context is use of the multi-project toolset. This toolset is not used more in this cluster, but it does explain performing-maturity in this one only. Many large software development and large engineering and construction endeavors are managed as programs or portfolios of projects, with the need to manage organizational capacity and to prioritize. These are all elements of this toolset, as can be seen in the Appendix. Note that the percentage of variance explained (37%) is high.

C4: More Performing-Maturity, Better-Defined Projects, and Greater Use of Tools. The scores are already higher for performing-maturity in this archetype. It is more difficult to differentiate within this context, as shown by the lower percentage of variance explained by the regression model. Nineteen percent is, however, not insignificant; with only two toolsets in the regression model, databases and team management, each is contributing significantly to explaining higher scores for performing-maturity. The team management, as previously mentioned, departs from the traditional "hard" project management toolsets. Considering that only two toolsets are significant in this cluster, team management may represent the ultimate key to reaching the highest levels of performing-maturity. On the other hand, performing-maturity is clearly associated with well-defined and "definable" projects. Performing-maturity may thus alternatively find its culminating expression through databases suggesting that when projects can be modeled in such a knowledge structure, they really are definable and predisposed to performing-maturity. Finally, considering the small R^2, something else is making the difference, something that is not measured by this research.

C5: Public Sector, Functional Structure, Mostly Internal Projects. This is the only contextual archetype for which the databases are not differentiating best practices; databases are also significantly used less in this cluster. As they are not best practices, their less extensive use may be rational. However, it is not clear why this is the case. Future research may elucidate this issue.

The first-ranked toolset is project closure, and this toolset is used significantly less in this context compared to most others, as shown in Table 3. This toolset is also highly influential in C1, which is also doing significantly more internal projects. External projects are forced to come to an end by contract and thus lend themselves to project closure processes. Carrying out these processes for internal projects, particularly in the public sector archetype, where closure tools are used less, certainly requires extra effort, but it is associated with higher scores for performing-maturity.

The last significant item in the regression is related to project structure; C5 is 100% from the public sector, and the structure is significantly more functional than all other archetypes. Again it probably takes an extra effort in the public sector to implement a strong matrix or projectized structure, but when this is the case it is associated with higher scores for performing-maturity.

Conclusion

The objective of this research is to investigate contextual variations in project practice. The analysis uncovered a new construct, performing-maturity, which is an important research result in its own right. Performing-maturity is an original performance measure that emerged from the present study, performance in terms of project success through project management maturity, organizational support for project management practice and the availability of competent personnel. This is a preliminary construct and needs further investigation.

As shown by the vertical dimension in Figure 2, links were found between performing-maturity, use of all toolsets, and project definition. The link between performing-maturity and the extent of use of all toolsets is intuitive; more mature organizations with more support for use of toolsets use them more extensively. A clear link was also identified with project definition, top performers succeeding in doing better-defined projects while the poorest performers struggle with ill-defined projects. The identification of the structuring effect of project definition is an important result. Whether higher levels of performing-maturity and greater use of tools lead to better-defined projects or whether these tools and practices are more applicable to "definable" projects is unclear, but whatever the nature of the causality, the structuring effect of project definition is clear.

For some time, project management has been thought to have both a generic component and a component that varies contextually. The list of tools, techniques, and practices identified in this study constitutes the basis of generic practice, as the practices are used in varying degrees in all contexts, as shown in Table 1. The list of toolsets presented in Table 1 is more than a generic list; it also provides information on the average extent of use. This could be termed the "average practice." Table 3 enriches the description and shows how the extent of use varies, often significantly, between contexts.

Cluster analysis was used to identify multidimensional contextual archetypes. The resulting five archetypes revealed first that project management is practiced in very different contexts and that these contexts are defined by complex interactions among several dimensions of context, some of which have opposing effects on practice. Through the analysis of the contextual archetypes, it has become clear that the identification of the configuration of relevant variables that define a context in which project management is practiced is not easily accomplished through the examination of context variables and their impact on practice taken one at a time. These results show that it may be impossible to identify the set of contextual factors at play and their interactions intuitively or through direct observation or simple bivariate analysis. This situation is even more evident in the real workplace; because only one case is observed, knowing which aspects of context will be determinant of project practice and which practices will have the most impact on performance becomes nearly impossible.

None of the practices is a "best practice" in all of the contexts. But a group of four best practices in the overall sample are also best practices in at least three of the five contexts: (1) initial planning, (2) databases, (3) business case definition, (4) baseline change management, and (5) team management. These may be considered "general best practices" in most contexts.

The processes for producing standards on practice are largely opinion-based. The reality of practice can be investigated empirically, and the empirical results should be used to inform the production and revision of standards. Toolsets are used in many different contexts, each with its particular management problems, for which project management practices have been adapted and skills developed in their use—skills that can be documented, learned, and transferred. In this way, organizations and their project managers can configure their project management practices as a means to build a strategic asset. ■

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Appendix: Composition of the 17 Toolsets

	Average Use
Toolset: Initial planning	**3.27**
Kickoff meeting	3.74
Milestone planning	3.47
Scope statement	3.40
Work breakdown structure	3.32
Project charter	3.04
Responsibility assignment matrix	3.01
Communication plan	2.92
Toolset: Project closure	**2.95**
Client acceptance form	3.06
Project closure documents	3.06
Lesson learned/postmortem	2.93
Customer satisfaction surveys	2.92
Quality plan	2.78
Toolset: Basic PM software functionality	**2.95**
Gantt chart	3.59
PM software for task scheduling	3.52
PM software for monitoring of schedule	3.06
PM software for resource scheduling	3.02
PM software for monitoring of cost	2.56
PM software for resource leveling	2.51
PM software for multiproject scheduling	2.36
Toolset: Business case definition	**2.94**
Assigned project sponsor	3.29
Needs analysis	3.12
Business opportunity/problem definition	3.11
Business case	3.07
Project mission statement	2.70
Updated business case at gates	2.37
Toolset: Bidding and fixed-price contract	**2.81**
Contract documents	3.29
Fixed-price contract	3.06
Bid documents	2.86
Bid/seller evaluation	2.60
Contractual commitment data	2.26
Toolset: Progress monitoring	**2.76**
Progress report	3.86
Stage gate reviews	2.76
Project scorecard/dashboard	2.67
Monitoring critical success factors	2.64
Trend report	2.39
Earned value	2.25
Toolset: Baseline change management	**2.72**
Change request	3.48
Baseline plan	3.16
Change control board	2.87
Re-baselining	2.69
Configuration review	2.40
Management reserve	2.39
Recovery schedule	2.06
Toolset: Financial evaluation	**2.71**
Cost/benefit analysis	2.83
ROI, VAN, IRR, or payback	2.58

	Average Use
Toolset: Project analysis	**2.71**
Requirements analysis	3.47
Feasibility study	2.71
Stakeholder analysis	2.62
Value analysis	2.04
Toolset: Risk management	**2.68**
Risk management documents	2.91
Ranking of risks	2.84
Contingency plans	2.77
Assignment of risk ownership	2.70
Graphic presentation of risk information	2.17
Toolset: Team management	**2.37**
Self-directed work teams	2.66
Team-building event	2.63
Project website	2.38
Project war room	2.24
PM community of practice	2.18
Team development plan	2.16
Toolset: Multiproject management	**2.32**
Program master plan	2.60
Project priority ranking	2.54
Project portfolio analysis	2.28
Multicriteria project selection	2.26
Organizational capacity analysis	2.25
Graphic presentation of portfolio	1.98
Toolset: Network planning	**2.13**
Critical path method and analysis	2.63
Network diagram	2.25
Probabilistic duration estimate (PERT analysis)	1.85
Critical chain method and analysis	1.78
Toolset: Business benefits measures	**2.12**
Financial business benefits metrics	2.22
Medium-term post-evaluation of success	2.18
Nonfinancial business benefits metrics	1.97
Toolset: Databases	**2.10**
Database of historical data	2.23
Database for cost estimating	2.17
Database of lessons learned	2.08
Database of risks	1.91
Toolset: Variable price contract	**1.96**
Contract penalties	2.24
Cost-plus contract	2.17
Gain-share contract	1.49
Toolset: Advanced PM software functionality	**1.91**
PM software for multiproject resource management	2.21
PM software Internet access	2.19
PM software for issue management	2.00
PM software for project portfolio analysis	1.84
PM software linked with ERP	1.65
PM software for scenario analysis	1.57