

Project Management Practices in Private Organizations

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Abstract

This article aims to make a contribution to theory, as well as to practice, by identifying which project management practices are used by most private organizations in general and by sector of activity. The influence of practitioners' characteristics in the choice of project management practices and their use in groups are also analyzed. The results show that the most used project management practices are kick-off meetings, activity lists, progress meetings, Gantt charts, and baseline plans; however, differences between activity sectors and practitioners' characteristics were found. The results also indicate that the most used project management practices are, in fact, used as toolsets.

Keywords

project management, tools, techniques, practices, activity sector, toolsets

Introduction

Project management practices are gaining increasing visibility and importance to organizations (Badewi, 2016; Kwak & Anbari, 2009; Zhai, Xin, & Cheng, 2009); however, project management remains a highly problematical endeavor (Mir & Pinnington, 2014). The Standish Group International's *Chaos Manifesto 2015* shows that in the information and technology (IT) sector of activity, in 2015, only 29% of all the projects surveyed succeeded (i.e., were delivered on time, on budget, and with the required features and functions); 52% were challenged (late, over budget, and/or with less than the required features and functions); and 19% failed (canceled prior to completion or delivered and never used). Nevertheless, these results show an increase in project success rates since 2008, when the success rate was only 32%, highlighting the importance of applying better project management practices (The Standish Group, 2015).

According to Kerzner (2015), the use of the best project management practices leads to added business value, greater benefit realization, and better benefit management activities. Project management practices are required to ensure project success (Badewi, 2016). Several studies have been conducted to demonstrate the value of project management (Joslin & Müller, 2015; Lappe & Spang, 2014; Mir & Pinnington, 2014; Thomas & Mullaly, 2008; Zhai et al., 2009). Several authors have shown that project management delivers several tangible and intangible benefits to organizations—for example, tangible benefits, such as better financial ratio of return on

investment (Ibbs & Kwak, 2000), and intangible benefits, such as corporate culture, organization efficiency, and client satisfaction (Andersen & Vaagaasar, 2009; Eskerod & Riis, 2009; Mengel, Cowan-Sahadath, & Follert, 2009).

Project management bodies of knowledge are used by practitioners as “best practice” guides to what the project management discipline comprises. The project management body of knowledge is the sum of knowledge within the profession of project management, which includes proven traditional practices that are widely applied, as well as innovative practices that are emerging in the profession, including published and unpublished material (Peng, Junwen, & Huating, 2007). There has been an emergence of multiple bodies of knowledge and/or standards, including *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* – Sixth Edition, from the Project Management Institute (PMI, 2017); *APM Body of Knowledge* (APM BOK) from the Association for Project Management (APM, 2012); *Individual Competence Baseline*

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(ICB4) from the International Project Management Association (IPMA, 2015); and *A Guidebook of Project & Program Management for Enterprise Innovation (P2M)* from the Project Management Association of Japan (PMAJ, 2005). The attempts to systematize the knowledge required to manage projects through bodies of knowledge are largely based on the underlying assumption that there are identifiable patterns and generalizations, from which rules, controls, and guidelines for “best practices” can be established that are replicable, even if not in every circumstance. The *PMBOK® Guide* has been used as the source of this study owing to its extent of use in the context studied.

Although the project management paradigm is surprisingly well defined through generic bodies of knowledge, project management is highly contingent on the organizational context, such as the structure of the business or sector, the size, and the organization environment (Besner & Hobbs, 2008, 2012a, 2012b; Cooke-Davies, Crawford, & Lechler, 2009; Hobbs, Aubry, & Thuillier, 2008; Zwikaël, 2009). However, the *PMBOK® Guide*, for example, recognized that “‘Good practice’ does not mean that the knowledge described should always be applied uniformly to all projects” (Project Management Institute, 2017, p. 28); the organization and/or project management team is responsible for determining what is appropriate for any given project.

Cooke-Davies et al. (2009) argue that the value of project management is a function of what is implemented and how well it fits the organizational context. Project management value is created or destroyed depending on the extent of “fit” or “misfit” between the organization’s strategic drivers and the characteristics of its project management system. They particularly criticize the unconditional use of project management standards and view a misfit between specific project characteristics and the chosen management approach as a major source of project failure.

According to Besner and Hobbs (2013): “Three of the limitations of the project management bodies of knowledge and/or standards 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” (p. 17). The research reported in this article aims to contribute to these current shortcomings in the literature and standards, specifically by addressing the following research questions:

1. What are the most used project management practices in private organizations?
2. How do the most used project management practices vary in different sectors of activity?
3. Do the respondents’ characteristics influence the use of project management practices?
4. Are the most used project management practices clustered into groups?

The research described in this article aims to make a contribution to help organizations identify the practices most used by similar organizations (as a benchmark) and to define, based on this knowledge, priorities for selecting practices that can be implemented in each case. The research also intends to provide guidance on these issues to institutions that teach and train people in project management.

Benchmarking has several advantages (Barber, 2004; Dey, 2002; Luu, Kim, & Huynh, 2008):

1. Encourages a culture of continuous improvement in project management;
2. Allows using new ideas of proven practices;
3. May generate a higher level of commitment;
4. Can lead to the discovery of radically different approaches to the same problems;
5. Prevents the company from being only internally focused; and
6. Allows the company to develop a concrete understanding of competition.

This can help companies to gain a competitive advantage in relation to those competitors that do not make use of benchmarking (Elmuti & Kathawala, 1997).

Project management practices in this study are viewed as those tools and techniques that practitioners use to “execute a project management process,” such as a work breakdown structure or project charter. Tools and techniques are related to the day-to-day practice, related to the things people do (Besner & Hobbs, 2008).

Recently, Fernandes, Ward, and Araújo (2013) conducted similar research, but instead of the most used project management practices, they studied the most useful project management practices—that is, the project management practices that have a high level of benefit to project management performance. Project management performance is focused on the triple constraints: control of time, cost, and progress of the project (Jha & Iyer, 2007). The decision of this study to focus on the most used practices and not the most useful is related to the fact that it is more difficult for practitioners to evaluate the usefulness of a project management practice than its extent of use.

Despite this, the extent of use, as recognized by several authors, has a limitation: There is no relationship between variation in extent of use and contribution to project performance (Besner & Hobbs, 2006; Papke-Shields, Beise, & Quan, 2010; Patanakul & Iewwongcharoen, 2010). Some practices that are used contribute significantly to project management performance, whereas others do not. The same is also true for practices that are used very little. If some practices are used systematically, because they are seen as helpful for a wide range of projects, then it would be mathematically impossible to show a positive correlation with project success, because these practices are indeed a constant. Moreover, this also begs the question of project management practices benchmarking

usefulness, since, for example, there is a danger that the usage may reflect management fashions.

Fads and fashions in management are well-understood phenomena (Abrahamson & Fairchild, 1999; Whitty, 2005). They can facilitate the diffusion of technically inefficient new project management practices. According to the fads and fashions theory proposed by Abrahamson (1991), decision makers feel impelled to accept innovations as some practices come to be seen as more modern, professional, or cutting-edge.

Nevertheless, this study focuses on a survey of the actual project management practices in private organizations, because the analysis of the usage of a practice appears to be more robust than that of the usefulness of a practice, in which the barriers to really using it would be ignored. So, gaining more knowledge about project management practice usage is seen as a good complementary research strategy to the already existing studies.

The final goal was to investigate if the most used project management practices are somehow related, and jointly used in groups of toolsets. A similar study was done by Besner and Hobbs (2012a), based on a sample of 2,339 practitioners participating in a large-scale international survey. Using principal component analysis, the authors identified patterns that demonstrate that practitioners use project management tools and techniques jointly in groups or toolsets. This study was later complemented, with clusters named *contextual archetypes*. These archetypes of contextualized practice were then investigated through the study of the extent of use of empirically identified toolsets in each cluster (Besner & Hobbs, 2013).

Literature Review

Project Management Concepts

There is no universal agreement on the definition of what a project is. However, its classical definitions usually include: (1) the characteristics of established quantitative and qualitative objective(s), (2) a set of activities that are complex enough to need managing (uniqueness), and (3) a defined start time and finish time (temporary) (Cooke-Davies, 2001). These characteristics have implications for rethinking the definition of what constitutes a project (Maylor, Brady, Cooke-Davies, & Hodgson, 2006). In practice, the concept of a project has been broadened from an initial focus on the management of largely unitary/standalone projects with well-defined and agreed-upon goals and end products to include multiple projects and programs that are multidisciplinary and not predefined but rather are permeable, contested, and open to renegotiation throughout (Atkinson, Crawford, & Ward, 2006).

In this study, we adopted the traditional view, defining a project as “a temporary endeavor undertaken to create a unique product, service, or result” (PMI, 2017, p. 4). A project comprises a set of defined deliverables and the scope to fulfill the project’s objectives (IPMA, 2006) and is constrained by time, cost, and predetermined performance specifications (Gaddis, 1959; Turner, 2014).

Project management is a subfield of management and organization studies (Söderlund, 2011). There are several definitions of project management, most of them come from project management professional organizations; however, they all specify the same concept. For example, the Association for Project Management (APM, 2012) defines project management as “the process by which projects are defined, planned, monitored, controlled and delivered such that the agreed benefits are realised” (p. 2). Project management can be described as a form of implementation that aims to improve the work in order to achieve high performance (Loo, 2002); it comprises activities or processes that add value to the final product of the project and therefore to the organization where it is implemented. In this study, project management is seen as a disciplined method of achieving well-defined goals through the deployment of tried-and-tested tools and techniques for planning, organizing, evaluating, and controlling work.

Project management practices, when applied properly, lead to an increase in the probability of project success (Thomas & Mullaly, 2008). However, each organization must assess the applicability of each practice because their use may not have the same effect for different organizations. Project management, therefore, can be implemented by means of tools and techniques, which should be tailored to the organization’s context.

Tailoring delineates how to adapt processes, tools, and techniques of the organization to every type of project, in order to meet each one’s needs (PMI, 2017). As Crawford, Hobbs, and Turner (2005) stated about the project management approach: “there was greater success when procedures were tailored to project type than when a common approach was used” (p. 13). The implementation of tailored project management tools and techniques in organizations is identified by Fernandes, Ward, and Araújo (2014) as one of the 15 key project management improvement initiatives to improve project management practice in organizations.

There are various standards and methodologies, mentioned before, documenting project management practices, which may give guidance to develop tailored project management processes.

Project Management Practices

Several companies in different industries have begun to understand the benefits they can get when applying the practices of project management.

Increasingly, the field of project management has promoted itself as a universal and politically neutral toolkit of techniques appropriate for any type of activity in any sector, enabling the tight control of discontinuous work processes, with particular potential for the control of expert labour. (Hodgson, 2002, p. 804)

This study considered the project management practices discussed in the *PMBOK® Guide*, from the Project

Management Institute (PMI, 2017). Project Management Institute is a U.S. not-for-profit organization founded in 1969. The *PMBOK® Guide* defines guidelines for project management that aim to promote and expand knowledge in the field. The sixth edition of the *PMBOK® Guide* identifies 10 Knowledge Areas: Project Integration Management, Project Scope Management, Project Schedule Management, Project Cost Management, Project Quality Management, Project Resource Management, Project Communications Management, Project Risk Management, Project Procurement Management, and Project Stakeholder Management. According to Marchewka (2015), those considered most important are the scope, schedule, cost, and quality management areas, which correspond to the main objectives of project management.

A study conducted in 30 metalworking companies in Portugal revealed that the management practices were valued by the practitioners for all Knowledge Areas, with Project Scope Management and Project Procurement Management being considered the most important, and Project Risk Management and Project Integration Management the least important. This study was conducted through questionnaires. The study also revealed that the majority of the projects considered did not achieve the desired results. Considering the importance of the practices, those related to planning of activities, human resources, costs, and communications were considered the most important (Pinto & Dominguez, 2012).

Specific empirical studies have been conducted that identified the most used tools—for example, White and Fortune (2002) and Besner and Hobbs (2006). White and Fortune (2002) conducted a survey that was designed to determine the extent to which those involved in the management of projects actually make use of the methods and techniques that are available and the effectiveness of the methods and techniques used. The authors listed 44 methods, methodologies, tools, and techniques and asked the respondents to indicate which had been used in the project under analysis in the survey. The options chosen to be included in the list were those found in a selection of standard textbooks on project management (e.g., Kerzner, 2017). From an analysis of 236 participants, White and Fortune (2002) found that the most commonly used tools identified were “off the shelf” software (77% of the respondents), Gantt charts (64%), and cost–benefit analysis (37%).

Another questionnaire survey undertaken by Besner and Hobbs (2006) analyzed usage of 70 tools and techniques for 753 respondents. Besner and Hobbs (2006) found that the levels of usage of the tools and techniques varied considerably—from 1.4 to 4.1—based on a scale ranging from 1 (*not used*) to 5 (*very extensive use*). Table 1 lists the 70 tools and techniques included in Besner and Hobbs’s (2006) survey in decreasing order by level of usage, from top to bottom and left to right.

Besner and Hobbs’s (2006) findings are consistent with the results from White and Fortune (2002). Although Besner and

Table 1. The 70 Tools Identified by Besner and Hobbs (2006) in Decreasing Order of Level of Usage

1. Progress Report	27. Critical Path Method	50. Database for Cost Estimating
2. Kick-off Meeting	28. Bottom-up Estimating	51. Database of Lessons Learned
3. Project Management Software for Task Scheduling	29. Team Member Performance Appraisal	52. Product Breakdown Structure
4. Gantt Chart	30. Team-Building Event	53. Bidders Conferences
5. Project Scope Statement	31. Work Authorization	54. Learning Curve
6. Milestone Planning	32. Self-Directed Work Teams	55. Parametric Estimating
7. Change Request	33. Ranking of Risks	56. Graphic Presentation of Risk Information
8. Requirements Analysis	34. Financial Measurement Tools	57. Life Cycle Cost
9. Work Breakdown Structure	35. Quality Plan	58. Database of Contractual Commitment Data
10. Statement of Work	36. Bid Documents	59. Probabilistic Duration Estimate (PERT)
11. Activity List	37. Feasibility Study	60. Quality Function Deployment
12. Project Management Software for Monitoring Schedule	38. Configuration Review	61. Value Analysis
13. Lessons Learned	39. Stakeholders Analysis	62. Database of Risks
14. Baseline Plan	40. Project Management Software for Resource Leveling	63. Trend Chart or S-Curve
15. Client Acceptance Form	41. Project Management Software for Monitoring Cost	64. Control Charts
16. Quality Inspection	42. Network Diagram	65. Decision Tree
17. Project Management Software for Resource Scheduling	43. Project Communication Room (War Room)	66. Cause-and-Effect Diagram
18. Project Charter	44. Project Website	67. Critical Chain Method
19. Responsibility Assignment Matrix	45. Bid/Seller Evaluation	68. Pareto Diagram
20. Customer Satisfaction Surveys	46. Database of Historical Data	69. Project Management Software for Simulation
21. Communication Plan	47. Project Management Software for Multiproject Scheduling/Leveling	70. Monte Carlo Analysis
22. Top-down Estimating	48. Earned Value	
23. Risk Management Documents	49. Project Management Software for Cost Estimating	
24. Contingency Plans		
25. Re-baselining		
26. Cost–Benefit Analysis		

Hobbs (2006) selected a larger number of tools and techniques, the most used tools identified from White and Fortune (2002) are also in Besner and Hobbs's top list (highlighted in bold in Table 1).

Based on continuing their process of data collection from 2004, Besner and Hobbs (2012a) collected data in another two phases (2007 and 2009). The authors undertook a further study with two main objectives: to demonstrate that practitioners use project management tools and techniques in groups or toolsets, and to compare the use of these toolsets among project types. This study showed that practice varies with the management of four different types of projects: engineering and construction projects, business and financial services projects, IT and telecommunications projects, and software development projects. Besner and Hobbs's (2012a) results are based on a larger number of tools and techniques surveyed (108), compared with their 2004 survey. Most of the tools included in Besner and Hobbs's 108 tools list (that are not in their 70 tools list) are applicable to portfolio management (e.g., graphic presentation of portfolio, project portfolio analysis, project priority ranking, multicriteria project selection or project management software for project portfolio analysis), which is beyond the scope of this research study, focused on the management of individual projects. Therefore, this study uses the work developed by Besner and Hobbs (2006) as a reference.

Research Methodology

Questionnaire Survey Method

There are several types of research strategies: experiment, survey, case study, action research, grounded theory, ethnography, and archival research (Saunders, Lewis, & Thornhill, 2009). The research strategy used was survey. The research method selected was an online questionnaire. These choices allowed us to collect a great amount of data in an inexpensive way. The other advantages of using this research method included the ability to reach out to several organizations simultaneously, to obtain data fast, and to collect a broad variety of data that are easy to explain and understand.

There are several ways of conducting a questionnaire: by telephone, paper, email, and so forth. For this study, we chose to develop a survey from scratch, differentiating it from other surveys. The survey was developed using HTML/CSS and PHP with open source tools (Zend Framework and MySQL for data storage). The purpose of this choice was to increase the response rate. A nontraditional user interface was created to facilitate interaction.

Questionnaire Design

The questionnaire was divided into eight different tabs. The first five tabs correspond to the project management Process Groups related to the different phases of the project life cycle: Initiating, Planning, Executing, Monitoring and Controlling, and Closing. The questionnaire included 79 well-known,

tried-and-tested tools and techniques (see Table 2) from the different Process Groups. An alternative would be to organize the questionnaire into the Knowledge Areas of the *PMBOK® Guide* (PMI, 2017). The choice of the tools and techniques came from cross-checking papers and studies published by different authors, including Besner and Hobbs (2006); Fernandes et al. (2013); Papke-Shields et al. (2010); and White and Fortune (2002). However, as explained earlier, the work that had the most influence in the selection was that from Besner and Hobbs (2006).

Of the 70 tools and techniques in the Besner and Hobbs (2006) study, 15 were also in the study from Papke-Shields et al. (2010), and 10 were covered in the study from White and Fortune (2002). From the Besner and Hobbs (2006) study, we selected 68 tools and techniques. Project management software for multiproject scheduling/leveling was excluded because this was related to portfolio management, and risk management documents were divided into risk identification, qualitative risk analysis, and quantitative risk analysis, for a total of 71 tools and techniques. Another eight tools and techniques from a doctoral study were also included (Fernandes et al., 2013)—namely, handover (from the proposal team to the project team), design of experiments, requirements traceability matrix, project issue log, progress meetings, risk reassessment, close contracts, and project closure documentation.

The questionnaire's final three tabs were used to collect information about the respondent, such as age, gender, current position, level of education, and professional seniority (experience) in project management; and about the organization, such as the activity sector, the current number of employees, turnover, balance value, and the strategic positioning of the organization; and a final tab was used to submit the questionnaire. The data were collected to allow for description of the sample and also to perform analyses of the differences between sectors of activity, organizational dimensions, and organizational strategies. In addition, several relations were studied to identify which factors have an influence on project management practices usage, such as age, gender, level of education, position, or experience. For example, we expected that people with more years of experience or a higher level of education would make more extensive use of project management practices.

In the part of the questionnaire related to project management practices, described by the 79 tools and techniques selected, the respondent was asked to classify the degree of usage of each tool and technique by means of a 1 to 5 scale, with 1 meaning "never used," 2 meaning "rarely used," 3 meaning "occasionally used," 4 meaning "often used," and 5 meaning "always used." Because the questionnaire was custom made, jQuery Ui Tooltip was used to provide a small description of each tool and technique (Wideman, 2002).

Because project management is applied in different activity sectors, the following were selected for this study, as defined

Table 2. The 79 Project Management Tools and Techniques Surveyed, in Alphabetical Order

Activity List	Financial Measurement Tools	Project Management Software for Task Scheduling
Baseline Plan	Gantt Chart	Project Scope Statement
Bid Documents	Graphic Presentation of Risk Information	Project Statement of Work
Bid/Seller Evaluation	Handover	Project Website
Bidders Conferences	Kick-off Meeting	Qualitative Risk Analysis
Bottom-up Estimating	Learning Curve	Quality Function Deployment
Cause-and-Effect Diagram	Lessons Learned	Quality Inspection
Change Request	Life Cycle Cost	Quality Plan
Client Acceptance Form	Milestone Planning	Quantitative Risk Analysis
Close Contracts	Monte Carlo Analysis	Ranking of Risks
Communication Plan	Network Diagram	Re-baselining
Configuration Review	Parametric Estimating	Requirements Analysis
Contingency Plans/Risk Response Plan	Pareto Diagram	Requirements Traceability Matrix
Control Charts	Probabilistic Duration Estimate (PERT)	Responsibility Assignment Matrix
Cost-Benefit Analysis	Product Breakdown Structure	Risk Identification
Critical Chain Method	Progress Meetings	Risk Reassessment
Critical Path Method	Progress Report	Self-Directed Work Teams
Customer Satisfaction Surveys	Project Charter	Stakeholders Analysis
Database for Cost Estimating	Project Closure Documentation	Team-Building Event
Database of Contractual Commitment Data	Project Communication Room	Team Member Performance Appraisal
Database of Historical Data	Project Issue Log	Top-down Estimating
Database of Lessons Learned	Project Management Software for Cost Estimating	Trend Chart or S-Curve
Database of Risks	Project Management Software for Monitoring Cost	Value Analysis
Decision Tree	Project Management Software for Monitoring Schedule	Work Authorization
Design of Experiments	Project Management Software for Resource Leveling	Work Breakdown Structure
Earned Value Management	Project Management Software for Resource Scheduling	
Feasibility Study	Project Management Software for Simulation	

by the Classification of Economic Activities from the Portuguese National Statistics Institute (INE, 2014):

- Information and Communication—This sector comprises the activities related to the development of technological resources, hardware, and software that ensure and facilitate communication in various areas.
- Construction—The construction sector consists of three segments: development and construction of buildings, civil engineering, and specialized construction activities.
- Services—These consist of personal services activities, meal services, office services, and administrative and transport support.
- Manufacturing—The industry sector consists of converting raw material into marketable products.

The choice of these activity sectors was also related to the sectors present in the study by Besner and Hobbs (2006).

A pretest was done to verify the questionnaire's usability, understandability, length, and clarity. To perform this test, a convenience sample was used. The understanding and time required to complete the questionnaire were also assessed. Only minor revisions were required, for example, minor changes to questions to remove ambiguities and slight changes to the layout of the questionnaire to improve readability. After revision, the questionnaire was made available through the internet.

Sampling and Data Analysis

The study used a non-probabilistic technique for sampling, the “snowball” technique (Saunders et al., 2009). Because of personal privileged access, the researchers asked the two Portuguese Management Associations (the PMI Portugal Chapter and APOGEP [*Associação Portuguesa de Gestão de Projectos*; Portuguese Association of Project Management]) to advertise the survey to their members and ask them to send it to their colleagues. During a period of two months, a total of 159 responses were received. The answers were then imported into the database of the Statistical Package for the Social Sciences (SPSS; IBM, 2012).

According to Hill and Hill (2008), 100 respondents is the minimum sample size recommended for the application of any statistical technique. Chuan (2006) suggested the Cohen statistical power analysis for sample size estimation. In this regard, Baguley (2004), based on Cohen's (1992) guidelines, suggests the use of a conventional level of significance of 0.05 and a sample size of at least 85 participants. Therefore, we believed that a sample size of 159 respondents was adequate to validate the obtained results.

To obtain the 20 most used project management tools and techniques, the 79 tools in the survey were ranked in descending order according to the percentage of use.

Nonparametric techniques were used to perform data analysis as variables were presented in categorical types. In order to test the relation between variables (respondents' characteristics), a

Kruskal-Wallis test was used. The Mann-Whitney U test helped analyze the specific pairs for significant differences by the mean ranks computation (Field, 2013). Mean rank is an average ordinate of each category for each variable in the analysis. SPSS software was used for the analysis (IBM, 2012).

Additionally, factor analysis was also conducted to study the relations among the top 20 most used project management practices identified. Factor analysis is a collection of methods used to study the interrelationships among component variables (Fabrigar, MacCallum, Wegener, & Strahan, 1999). As explained by Bollen (2014), factor analysis is intended to simplify a concept by using relatively fewer underlying “latent variables” (i.e., non-observable variables; Bollen, 2014; Kline, 1994). This way, it helps in exploring the underlying theme structure of the constructs in a model (Kim & Mueller, 1978). If the correlation between variables is not significant, it is unlikely that the variables will present common “latent variables” or factors (Field, 2013).

Prior to the factor analysis, a Bartlett’s test of sphericity and a Kaiser-Meyer-Olkin (KMO) test were conducted in order to assess the factorability of the data. Bartlett’s test of sphericity should be $p < 0.5$ to be significant, whereas the KMO index ranges from 0 to 1. Factor analysis is assumed to be appropriate if KMO is higher than 0.6, although 0.7 or above is a better indicator of “factorability” (Field, 2013; Kim & Mueller, 1978).

Having assessed the factorability of the identified project management practices, “factor extraction” tests using Keiser’s criterion and Scree plot analysis were conducted. Factor extraction is the determination of the number of “factors” necessary to represent the data (Kim & Mueller, 1978). Kaiser’s test is one of the most commonly used techniques, otherwise known as the eigenvalue rule (Field, 2013). Using this rule, only the factors with an eigenvalue greater than 1 should be considered for further investigation (Kim & Mueller, 1978). On the other hand, the Scree test involves plotting each eigenvalue associated with each extracted factor, and the point at which the plot starts to level off in a linear manner often indicates the number of factors to select for a specific construct. A combination of these techniques was applied in a complementary manner in this research.

The extraction method used was principal component analysis. The SPSS software package offers seven methods of “factor extraction”—namely, weighted least squares, generalized least squares, maximum likelihood, principal axis factoring, alpha factoring, image factoring, and principal component analysis. The chosen rotation method was the varimax method, because it minimizes the incidence of items that have high loadings on each given factor, simplifying the interpretation of results.

Results and Discussion

The Dataset

Completed questionnaires were received from 159 practitioners. To better understand the results, a characterization of

the respondents was made. Only 6.3% of the respondents were under 30 years of age, a vast majority were between 30 and 49 years old (80.4%), and 13.3% were older than 49.

Regarding professional seniority (or experience), approximately one half of the sample had less than 10 years of experience in project management, 32.2% had between 10 and 15 years of experience, and 17.6% had more than 15 years of experience in this field. Most of the respondents held a project manager position (57.2%), whereas about 16.4% were directors. Program manager and portfolio manager positions were reported by 9.4% of the respondents; 5.7% held a manager position; about 5% were members of the project team; and 6.3% of the respondents reported a different position. Results showed that the higher hierarchical positions were occupied by senior-level people ($H(5) = 29.123, p < 0.001; N = 159$) and people with more years of work experience ($H(5) = 42.043, p < 0.001; N = 159$), as expected. Indeed, as can be observed in Figure 1, for example, most of the directors were older than 50 years, whereas the project manager position was held mainly by younger people.

Most of the respondents received a degree (36.5%), 32.1% received a postgraduate degree, 24.5% had a master’s degree, whereas 3.1% had a doctoral degree. About 1.9% of the respondents received an undergraduate technical education and the remainder (1.9%) did not specify the type of education they had received.

The most representative sectors of activity were those corresponding to the information and communication (48.4%) and services (20.1%) sectors, followed by the manufacturing sector (11.3%), and with a lower percentage (7.5%), the construction sector. About 12.7% of the respondents did not specify their sector of activity.

Most Used Project Management Practices

To answer the first research question: “What are the most used project management practices in private organizations?” The 79 project management tools and techniques surveyed were ranked in descending order, and the 20 most used are highlighted in Table 3.

Regarding the 20 tools and techniques, the position in our study is presented by the Process Groups as follows:

1. **Initiating Process Group:** kick-off meeting and project charter (1st and 16th positions, respectively);
2. **Planning Process Group:** work breakdown structure (9th position); requirements analysis (11th position); project scope statement (13th position); baseline plan (5th position); activity list, Gantt chart, and milestone planning (2nd, 4th, and 8th positions, respectively); risk identification (19th position);
3. **Executing Process Group:** project issue log and lessons learned (15th and 18th positions, respectively);
4. **Monitoring and Controlling Process Group:** progress meetings, progress report, change request, project

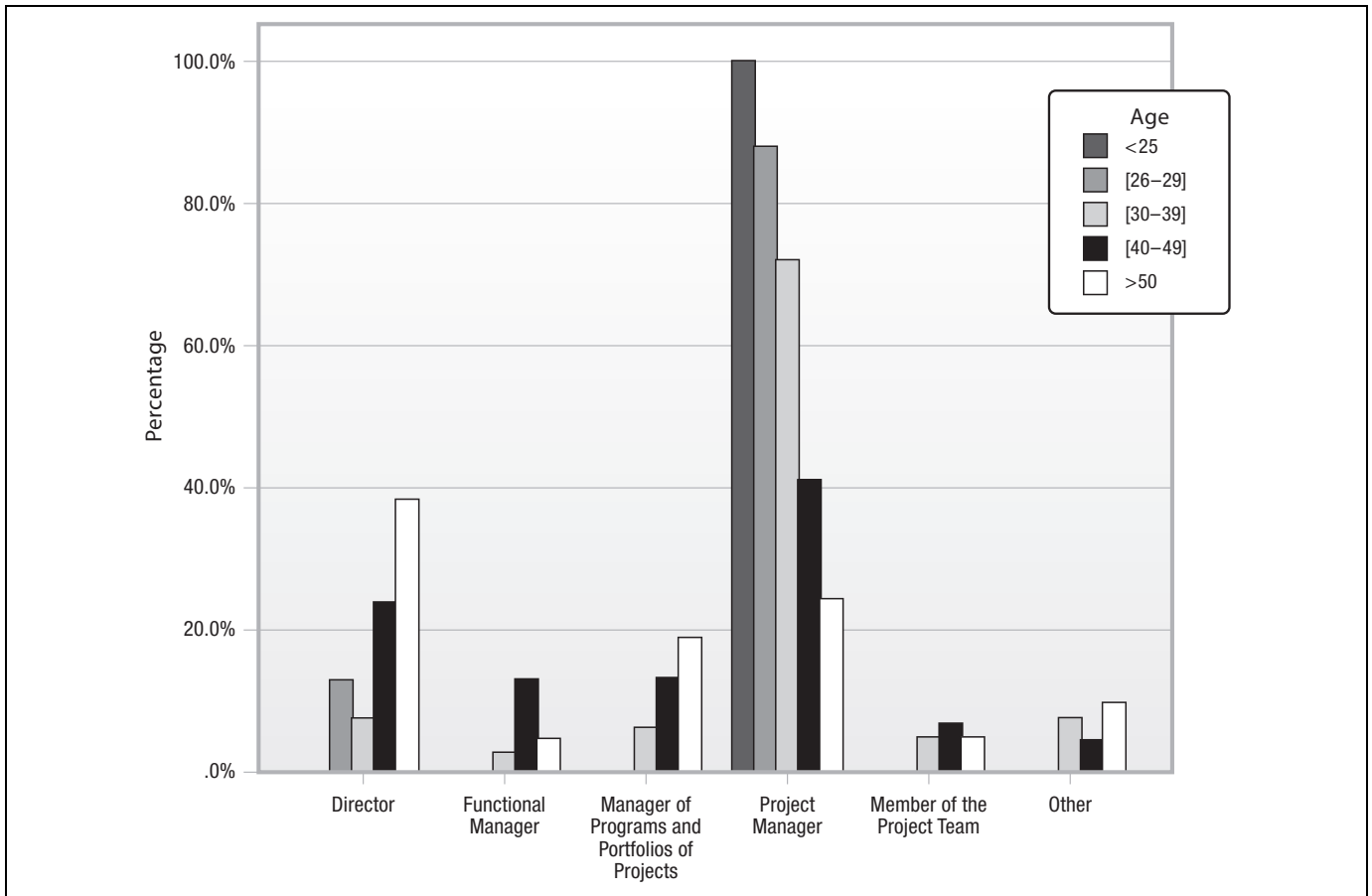


Figure 1. Age distribution of respondents by current position.

management software for monitoring schedule and customer satisfaction surveys (3rd, 6th, 12th, 20th, and 14th positions, respectively);

5. **Closing Process Group:** client acceptance form, project closure documentation, and close contracts (7th, 10th, and 17th positions, respectively).

The top 20 list of the most useful tools and techniques is composed of very well-known and widely used tools. There are few surprises here. The top 20 cover the overall project management life cycle from Initiation to project Closing, but particular relevance is given to tools and techniques from Planning, and curiously, to tools and techniques from Closing. The Knowledge Areas, Project Integration Management, Project Scope Management, and Project Schedule Management, assume a high relevance among the most useful project management practices, each with at least three project management practices at the top of the list. For example, under scope management practices, requirements analysis, project scope statement, and work breakdown structure were identified. Curiously, none of the tools from the areas of cost or quality, typically related to the project's objectives, was at the top of the list.

Based on the Besner and Hobbs (2006) study, a comparative analysis was performed. The 20 tools and techniques most used

by the private organizations (see Table 3) were compared with the top 20 most used in the Besner and Hobbs study (2006). Both studies have in common the use of 15 of the 20 tools (see Table 4). Note that the Gantt chart and the work breakdown structure had exactly the same positions in terms of preference of use, meaning that in both studies they are the fourth and ninth most used tools, respectively.

Curiously, the other five tools and techniques on the top 20 list were not even surveyed in the study by Besner and Hobbs (2006). Three of them were identified during the qualitative phase study from Fernandes et al. (2013)—namely, progress meetings (3rd position), project closure documentation (10th position), and Project Issue Log (15th position).

Most Used Project Management Practices by Sector of Activity

The second research question in the study was: “How do the most used project management practices vary in different sectors of activity?” Taking into consideration the distribution of the results by sector of activity, resulting from the exploratory analysis, it is possible to observe that project management is context dependent, as several studies have shown. For example, Zwikaël and Ahn (2011) demonstrated that the intensity of use

Table 3. The 79 Project Management Tools and Techniques Ranked by Usage in Descending Order

V1 Kick-off Meeting	28 Stakeholders Analysis	56 Database for Cost Estimating
V2 Activity List	29 Cost-Benefit Analysis	57 Database of Lessons Learned
V3 Progress Meetings	30 PM Software for Resource Scheduling	58 Network Diagram
V4 Gantt Chart	31 Team Member Performance Appraisal	59 Work Authorization
V5 Baseline Plan	32 Quality Plan	60 Critical Chain Method
V6 Progress Report	33 Product Breakdown Structure	61 Life Cycle Cost
V7 Client Acceptance Form	34 Quality Inspection	62 Probabilistic Duration Estimate (PERT)
V8 Milestone Planning	35 Critical Path Method	63 Team-Building Event
V9 Work Breakdown Structure	36 Bid/Seller Evaluation	64 Database of Risks
V10 Project Closure Documentation	37 Control Charts	65 Graphic Presentation of Risk Information
V11 Requirements Analysis	38 Requirements Traceability Matrix	66 Quality Function Deployment
V12 Change Request	39 Qualitative Risk Analysis	67 Value Analysis
V13 Project Scope Statement	40 PM Software for Monitoring Cost	68 Self-Directed Work Teams
V14 Customer Satisfaction Surveys	41 Feasibility Study	69 PM Software for Simulation
V15 Project Issue Log	42 Re-baselining	70 Database of Contractual Commitment Data
V16 Project Charter	43 Risk Reassessment	71 Decision Tree
V17 Close Contracts	44 Financial Measurement Tools	72 Cause-and-Effect Diagram
V18 Lessons Learned	45 Quantitative Risk Analysis	73 Design of Experiments
V19 Risk Identification	46 PM Software for Cost Estimating	74 Bidders Conferences
V20 PM Software for Monitoring Schedule	47 Configuration Review	75 Pareto Diagram
21 Communication Plan	48 Database of Historical Data	76 Learning Curve
22 Responsibility Assignment Matrix	49 Top-down Estimating	77 Parametric Estimating
23 Handover	50 Bid Documents	78 Trend Chart or S-Curve
24 PM Software for Task Scheduling	51 PM Software for Resource Leveling	79 Monte Carlo Analysis
25 Bottom-up Estimating	52 Ranking of Risks	
26 Project Statement of Work	53 Project Website	
27 Contingency Plans/Risk Response Plan	54 Earned Value Management	
	55 Project Communication Room	

Table 4. Study Comparisons of the 20 Most Used Tools and Techniques

Tool and Technique	Position in Our Study	Position in the Besner and Hobbs (2006) Study
Kick-off Meeting	1	2
Activity List	2	11
Progress Meetings	3	-
Gantt Chart	4	4
Baseline Plan	5	14
Progress Report	6	1
Client Acceptance Form	7	15
Milestone Planning	8	6
Work Breakdown Structure	9	9
Project Closure Documentation	10	-
Requirements Analysis	11	8
Change Request	12	7
Project Scope Statement	13	5
Customer Satisfaction Surveys	14	20
Project Issue Log	15	-
Project Charter	16	18
Close Contracts	17	-
Lessons Learned	18	13
Risk Identification	19	-
Project Management Software for Monitoring Schedule	20	12

Note. The “-” indicates that the tool/technique in the present study does not enter the category of the most used in the Besner and Hobbs study.

of risk management processes is dependent on industry activity.

Results showed that the 79 tools and techniques are used in the four activities sectors. After comparing the results, however, it was found that there is always a sector that uses a particular tool or technique more than the others. For example, the project charter is used more in the information and communication sector (62.4%), followed by the manufacturing sector (61.1%) and services sector (59.4%). The project charter is less used by the construction sector (41.7%).

In this study, the services sector was the one that used a greater variety of project management tools and techniques (27 from the total 79 tools and techniques), followed by the construction sector (with 23). The manufacturing sector used 18, whereas the information and communication sector used 14 of the total. Generally, in terms of frequency of use, the results showed that, on average, the services sector more often used project management tools and techniques, followed by the manufacturing sector and the information and communication sector. The sector that least frequently used project management tools and techniques was the construction sector. So, all the 79 tools and techniques are used in the four activities sectors but with varying frequency.

Considering the 159 obtained responses, the top 10 most used tools and techniques by activity sector (shaded in gray by Process Groups) are presented in Table 5.

Table 5. The Top 10 Most Used Project Management Tools and Techniques by Activity Sector, Shaded in Gray by Process Groups

Information and Communication	Construction		Services	Manufacturing	
Kick-off Meeting	Activity List		Activity List	Kick-off Meeting	
Progress Meetings	Baseline Plan		Kick-off Meeting	Activity List	
Gantt Chart	Close Contracts		Milestone Planning	Bid/Seller Evaluation	
Activity List	Cost-Benefit Analysis		Progress Report	Quality Inspection	
Baseline Plan	Gantt Chart		Gantt Chart	Baseline Plan	
Progress Report	Progress Meetings		Progress Meetings	Client Acceptance Form	
Change Request	Client Acceptance Form		Baseline Plan	Progress Report	
Client Acceptance Form	Project Closure Documentation		Project Closure Documentation	Milestone Planning	
Project Scope Statement	Bottom-up Estimating		Requirements Analysis	Progress Meetings	
Requirements Analysis	Milestone Planning		Work Breakdown Structure	Feasibility Study	
Process Groups	Initiating	Planning	Executing	Monitoring and Controlling	Closing

Results showed that, on the top 10 list, the only tool and technique of the Initiating Process Group is the kick-off meeting. Oddly, this tool is not in the top 10 most used tools, considering the responses of the construction sector.

Note that the most representative Process Group in this list is the Planning Process Group. Regarding this Process Group, all the activity sectors under analysis use the activity list and the baseline plan. These results are aligned with the study of Zwikael and Globerson (2006), which concluded that these identified most used practices—activity list and baseline plan—are also important practices for project success, showing in this case that the most used project management practices are also those that have the greatest impact on project performance.

The results also highlighted that bid/seller evaluation is the unique tool and technique of the Executing Process Group represented in the top 10; it is represented only in the manufacturing sector, although we would expect to find it in the construction sector as well.

As expected, by observing the Closing Process Group, we found that close contracts are one of the top 10 tools and techniques used by the construction sector, as this is the sector that usually uses subcontracting the most.

Most Used Project Management Practices: Influence of the Respondents' Characteristics

The third research question was “Do the respondents' characteristics influence the use of project management practices?” The influence of the gender, age, professional seniority, educational level, and current position on the tools and techniques selection was also analyzed. Because the variables under analysis are discrete, a study on the chi-square test (χ^2) was

performed. Conventionally, the significance value must be less than 0.05 in order to show an association between two variables (Field, 2013).

Results showed that gender does not have an influence on the tools' selection ($p > 0.05$) except for 15 of the 79 tools and techniques—for example, project statement of work, bid documents, design of experiments, parametric estimating, quantitative risk analysis, quality function deployment, team member performance appraisal, work authorization, cause-and-effect diagram and project management software for cost estimating, resource leveling, resource scheduling, task scheduling, and monitoring cost. Regarding the significance of the results, men use more tools and techniques than women (mean rank (Mdn) men $>$ (Mdn) women). Results also show evidence that age has an influence on the selection of 21 of the total analyzed tools and techniques ($p < 0.001$), for example: feasibility study, handover, cost-benefit analysis, decision tree, Monte Carlo analysis, top-down estimating, bid/seller evaluation, team member performance appraisal, cause-and-effect diagram, Pareto diagram, and customer satisfaction surveys. The results obtained seem to indicate that professional seniority has an influence on the selection of tools and techniques ($p < 0.001$), as does the respondents' current position ($p < 0.05$). The professional seniority of the respondents is highly related to the use of 39 of the 79 tools and techniques, including feasibility study, baseline plan, top-down estimating, bidder conferences, cause-and-effect diagram, and client acceptance form, to name just a few. Regarding the current positions of the respondents, significant results were found for just eight of the 79 tools and techniques (feasibility study, milestones planning, project scope statement, quantitative risk analysis, work breakdown structure, bid/seller evaluation, team-building event, and Pareto diagram). Depending on the tools and techniques, as the

position of the respondents gets higher, the more influence it has. For example, those respondents who have director positions preferentially selected the feasibility study (Mdn for director position = 101.77) and project scope statement (Mdn director = 91.00), whereas milestones planning, quantitative risk analysis, and work breakdown structure (WBS) were selected by those who have positions as managers of programs and portfolios (Mdn = 105.30, Mdn = 118.30, and Mdn = 100.50, respectively). In terms of career, the beginners in project management—that is, those who are team members—preferentially selected the bid/seller evaluation, team-building event, and Pareto diagram (Mdn = 118.31, Mdn = 110.00, and Mdn = 111.50, respectively).

The respondents' level of education does not have an influence on the tool selection ($p > 0.05$) except for six of the 79 tools and techniques that were analyzed—namely, Gantt chart, product breakdown structure, project scope statement, quality function deployment, requirements analysis, and control charts. Regarding these six tools and techniques, the results show evidence that the project scope statement is frequently used by those who have a postgraduate degree (Mdn = 87.57). Quality function deployment (Mdn = 93.50), requirements analysis (Mdn = 105.40), Gantt chart (Mdn = 110.50), and control charts (Mdn = 138) are selected preferentially by those with a PhD. The respondents with a degree often selected the product breakdown structure (Mdn graduation = 90.17) and the Gantt chart (Mdn = 110.50). These results seem to indicate that some of the most complex tools and techniques, such as quality functional deployment and control charts, are selected by those who have a higher level of education. Nevertheless, further studies are required, as some of those complex techniques did not present significantly statistical differences regarding level of education.

Regarding the respondents' aforementioned characteristics, no significant influence was found on the tools and techniques used per activity sector except for gender ($p < 0.05$). None of the other respondents' characteristics (educational level, professional seniority, current position, or age) showed significant influence on the tools and techniques used per activity sector. The Kruskal-Wallis test was used to follow up on these results. Results showed that the distribution of these characteristics is equal in all sectors of activity ($p < 0.05$), meaning that the differences do not have a statistical significance.

Most Used Project Management Practices, Clustered into Groups of Toolsets

The last research question was: "Are the most used project management practices clustered into groups?" Factor analysis was conducted to verify the relations among the top 20 most used project management practices identified.

Table 6 summarizes the factor analysis steps followed in this research and the results obtained to establish construct validity and better determine the structure of the project management practices toolset. In the Appendix at the end of the article, the rotated "factor" loading matrix and the variance explained for

Table 6. Factor Analysis Results

Steps	Results and Comments
1. Determination of "factorability"	- All items have at least half of more of their correlation > 0.3, except V1 - All data except V1 are suitable for factor analysis - KMO = 0.880 Including V1 - KMO = 0.878 Excluding V1 - KMO decreased 0.002; therefore, V1 is maintained for factor analysis - The data set has a "good" level for factor analysis (if $0.8 < \text{KMO} < 0.9$) - Barlett's test of sphericity is significant ($p \approx .000$) - The data are factorable - All items have communalities above the threshold level, except V4 with 0.481, very close to the threshold 0.5 - The data show factorability
2. Decision on number of "factors" (toolsets)	- In the first extraction, five "factors" had an eigenvalue > 1, explaining 64.3% of the total variance. However, the fifth factor only grouped two variables (V1 and V16) - A second extraction was run by reducing one "factor," obtaining a four-theme construct. A total explained variance of 59.2% was obtained, which was very close to the threshold 60% - Scree plot showed that four "factors" have an eigenvalue above 1, where the plot starts to flatten in a linear way confirming that the four-theme construct was the best option
3. Establishment of the "factor" (toolset) structure	The four-theme construct includes four "factors" comprising the following variables (see Appendix): - F1: V3, V4, V5, V6, V11, V12, V14, V20 - F2: V9, V15, V18, V19 - F3: V2, V7, V10, V17 - F4: V1, V8, V13, V16

Table 7. Reliability Analysis—Cronbach's Alpha Analysis

Toolset ("Factor" in Factor Analysis)	Cronbach's Alpha
F1: V3, V4, V5, V6, V11, V12, V14, V20	0.859
F2: V9, V15, V18, V19	0.807
F3: V2, V7, V10, V17	0.725
F4: V1, V8, V13, V16	0.660

each of the 20 most used project management practices are presented.

After establishing the final structure of the themes, it was necessary to conduct a reliability analysis (ability to replicate results when repeating the study under the same settings), using Cronbach's alpha analysis for the four "factors." Table 7 shows that all Cronbach's alpha values for each factor are above 0.5, which, according to Field (2013), is the minimum threshold

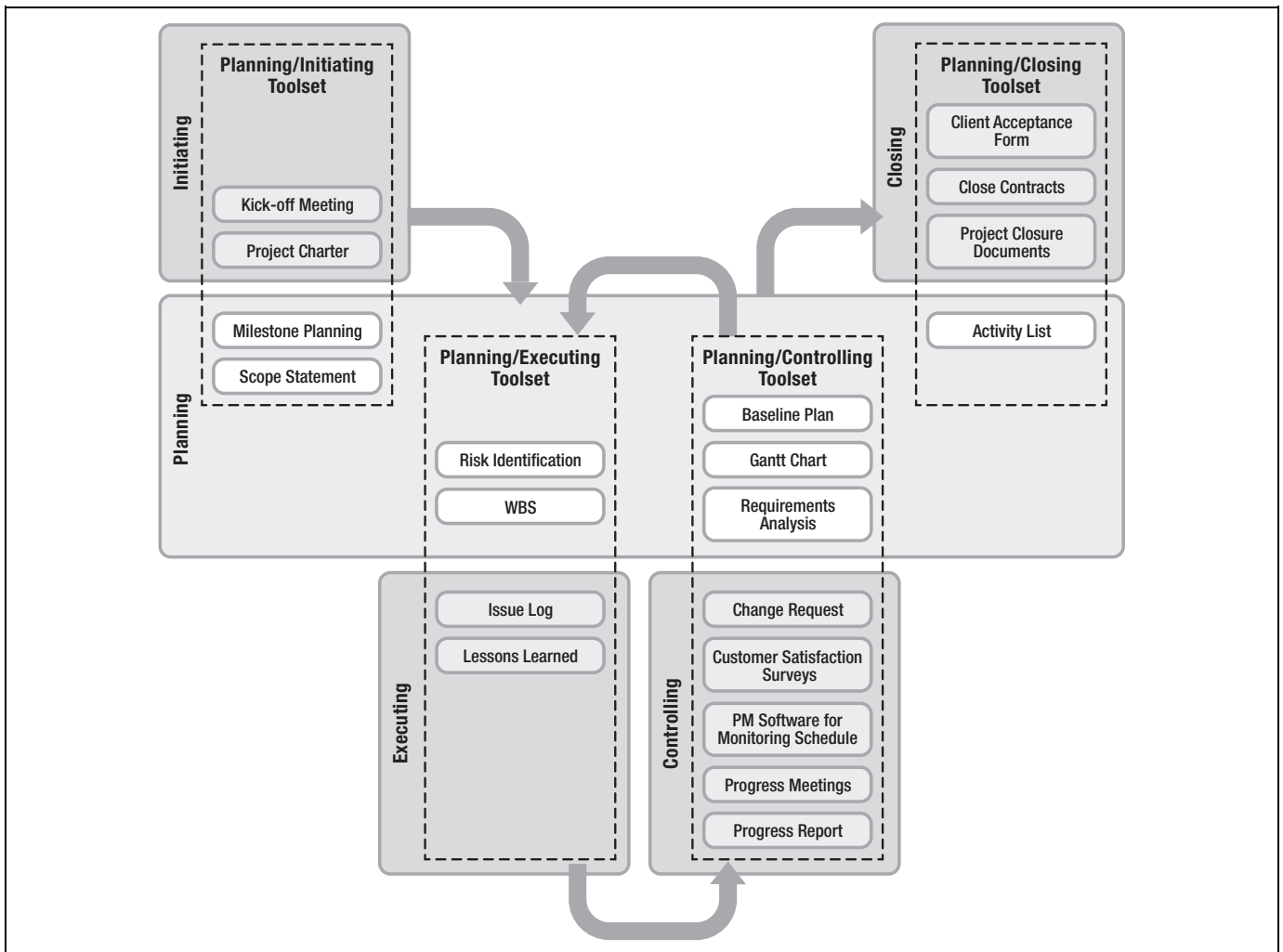


Figure 2. Project management practice toolset relationships.

(0.7 being the desirable threshold), which means the results are reliable.

Based on the nature of the questionnaire items V1 to V20, it was determined that:

- Factor #1 (V3, V4, V5, V6, V11, V12, V14, and V20), although V14 had slightly loaded higher on Factor #2 (V14 ‘loads’ in Factor #1: 0.475, and in Factor #2: 0.539), represents better the theme Planning/Controlling toolset;
- Factor #2 (V9, V15, V18, and V19), represents the theme Planning/Executing toolset;
- Factor #3 (V2, V7, V10, and V17) represents the theme Planning/Closing toolset; and
- Factor #4 (V1, V8, V13, and V16) represents the theme Planning/Initiating toolset.

In summary, the factory analysis conducted on items pertaining to project management practices is a 4-theme structure, i.e. a four-toolset of project management practices. Figure 2 shows

the results of the toolset clustering resulting from factor analysis. There is always a point in common between the four groups, relating the project management practices associated with planning with the project management practices of the four Process Groups—Initiating Process Group, Executing Process Group, Monitoring and Controlling Process Group, and Closing Process Group—forming four toolsets: Planning/Initiating toolset (Factor #4), Planning/Executing toolset (Factor #2), Planning/Controlling toolset (Factor #1), and Planning/Closing toolset (Factor #3).

The Planning/Initiating toolset (Factor #4) has strong coherence. There is an expected link between the completion of the project charter and the kick-off meeting. Simultaneously, related to these techniques of Initiation, the use of the techniques (project) scope statement and milestone planning is noted, typically containing high-level information established in the project charter.

The second toolset, called Planning/Executing (Factor #2) consists of risk identification, WBS, planning tools and techniques, and (project) issue log and lessons learned, and

executing tools and techniques, although risk identification is done throughout project execution. It is understood that typically one who does a detailed breakdown of the project work, which according to the *PMBOK® Guide* is carried out in the process Create WBS (PMI, 2017, p. 156), has a greater concern with the registration of project issues and risks, as well as lessons learned, throughout the execution of the project. The concern will be to register the problems, linking them in particular to the risks, but also to register new knowledge, in a perspective of continuous improvement, for the development of better work breakdown structures in future projects.

The third toolset, called Planning/Controlling (Factor #1), forms the set that has the most tools (40% of the total) and also has good coherence. The consistency of this group is focused on the techniques used in Monitoring and Controlling. By analyzing this toolset in more detail, we can refer to a number of aspects: (1) Several techniques used to monitor and control a project, such as progress report and progress meetings, use a baseline as a reference point, with baseline plan being the central element of project planning; (2) the Gantt chart, although a planning technique, is widely used for project control, mainly in schedule control, but also in scope—namely, through the use of project management software for monitoring schedule; (3) the practice of change request in controlling a project is (as would be expected) strongly related to the practice of baseline plan, and that change request is always done in relation to a baseline; (4) increasingly, projects present great complexity and degree of innovation, with a greater need to reanalyze and follow the requirements analysis; this is also linked to the growing dissemination of some agile practices in project management (Flora & Chande, 2014); and (5) customer satisfaction survey technique is related to the management of stakeholder expectations, proposed in the *PMBOK® Guide*'s process Monitor Stakeholder Engagement (PMI, 2017, p. 532).

The fourth toolset, called Planning/Closing, consists of four closure techniques: client acceptance form, close contracts, project closure documents, and a planning technique—activity list. When formal contracts exist in a project, the activity list is typically used because there is a greater need for rigor in detailed planning (greater granularity). Because in the closing phase of the project the contracts are formally closed, it is not surprising that the techniques of client acceptance form, close contracts, and project closure documents are applied, as the required formalization of the project is greater.

In summary, the strong coherence of the presented toolsets is evident. Interestingly, planning practices are strongly linked to the use of other techniques of Executing, Monitoring and Controlling, and Closing, thus forming four toolsets of project management practices.

Conclusions

Because of the financial crises the world is facing, it has become increasingly important for organizations to practice better project management. In this regard, organizations need to have a

better knowledge about the most used project management practices in private organizations, as well as those that best fit each sector of activity, and the organization's project management practitioners' characteristics. For instance, organizations from the construction sector might give more priority to the implementation of the practice close contracts than organizations from other sectors of activity. Also, organizations with practitioners who have a high level of education would prefer to implement more complex tools and techniques, such as quality functional deployment and control charts.

This article attempts to answer four research questions. To answer the first research question, "What are the most used project management practices in private organizations?" a survey with 79 tools and techniques, selected from previous studies, was released. From the 159 obtained responses, the 79 tools and techniques were ranked in descending order according to the percentage of use (see Table 3). The top 20 list of the most useful tools and techniques comprises very well-known and widely used tools from all phases of the project life cycle, with an emphasis on the planning phase. Integration, scope, and schedule were the most represented Knowledge Areas on the list. We also found that the top five tools and techniques were: kick-off meeting, activity list, progress meetings, Gantt chart, and baseline plan.

In relation to the second question, "How do the most used project management practices vary in different sectors of activity?" it was possible to identify the top 10 tools for each sector. The Planning Process Group was, as expected, the most representative group of processes on the top 10 tools. It was also important to note that activity list and baseline plan were in the top 10 in all sectors.

In relation to the third question "Do the respondents' characteristics influence the use of project management practices?" we found that a number of used tools and techniques are influenced by several characteristics—namely, age, professional experience, current position, and level of education: 21 tools and techniques were influenced by age (e.g., handover, database of lessons learned); 15 by gender (e.g., project statement of work, work authorization); 39 by professional experience (e.g., feasibility study, baseline plan); eight by current position (e.g., work breakdown structure, team-building event); and six by level of education (e.g., quality functional deployment, control charts). We also found that senior people and those with more job experience can have an influence on the types of tools and techniques selected.

Finally, for the fourth question "Are the most used project management practices clustered into groups?" we found that the most used project management practices are, in fact, clustered into groups. Interestingly, planning practices are strongly linked to the use of other techniques of Initiating, Executing, Monitoring and Controlling, and Closing, thus forming four toolsets of project management practices: Planning/Initiating, Planning/Executing, Planning/Controlling, and Planning/Closing. By following a process paradigm with the typical steps of a project (Initiation, Planning, Executing, Monitoring and

Controlling, and Closing), we present the usage patterns under a new lens.

The results support both the image of project management as a field with relatively uniform generic practice, and also show some differences across different sectors of activity, as also found by Besner and Hobbs (2008), and across project management practitioners' characteristics. For instance, organizations with practitioners with lower levels of education might not adopt more advanced and complex project management tools and techniques, because these practitioners might not have yet the necessary background knowledge.

For future work, it would be interesting to see whether these statistically significant differences come from people with any type of certification in the field, including the Project Management Professional (PMP)[®] certification, IPMA, and others. It would also be interesting to use these results on the construction of a decision-making model regarding the use of different tools and techniques. The model would be based, for example, on the type (activity sector) and size of the organizations, as well as on the characteristics of those responsible for their

implementation; therefore, it would be necessary to explore the task-related and people-related determinants of the project management practices' usage. For example, their use may be influenced not only by their usefulness within the project context, as discussed in this article, but also by their ease of use, the time and cost required, the capabilities and preferences of the project managers and their teams, or the negative side effects that the project management practices might have.

Finally, it would be useful to extend this work, in further research, to program and portfolio management practices. As shown in this article, project management practices are clustered into groups, so some practices show high synergies. If, for example, professionals want to perform project portfolio management, they need a bundle of practices—but which bundles are the most common ones? Despite all the potential new problems and shortcomings of such joint-usage analysis, it is a step in the right direction, one that has already been initiated by Besner and Hobbs (2013), and it provides some new insights into the limitations of standards raised in their study.

Appendix. Varimax Rotation and Variance Explained

Item	Project Management Practice	Toolset ("Factor" or "Component" in FA) ^a			
		1	2	3	4
V1	Kick-off Meeting	0.064	0.107	0.121	0.724
V2	Activity List	0.362	−0.032	0.564	0.395
V3	Progress Meetings	0.696	0.201	0.252	0.125
V4	Gantt Chart	0.591	0.176	0.059	0.313
V5	Baseline Plan	0.605	0.139	0.429	0.197
V6	Progress Report	0.707	0.099	0.360	0.199
V7	Client Acceptance Form	0.247	0.386	0.664	−0.072
V8	Milestone Planning	0.350	0.405	0.006	0.524
V9	Work Breakdown Structure	0.326	0.634	0.202	0.314
V10	Project Closure Documentation	0.206	0.346	0.698	0.045
V11	Requirements Analysis	0.510	0.501	0.223	−0.054
V12	Change Request	0.582	0.407	0.329	−0.044
V13	Project Scope Statement	0.490	0.367	−0.117	0.520
V14	Customer Satisfaction Surveys	0.475	0.539	0.007	−0.043
V15	Project Issue Log	0.121	0.595	0.369	0.184
V16	Project Charter	0.031	0.051	0.453	0.611
V17	Close Contracts	0.169	0.165	0.543	0.244
V18	Lessons Learned	0.080	0.789	0.279	0.083
V19	Risk Identification	0.168	0.710	0.118	0.252
V20	PM Software for Monitoring Schedule	0.736	0.132	0.118	0.059
Eigenvalues		7,873	1,397	1,326	1,238
Percentage of variance explained		19.3%	16.6%	13.0%	10.3%

Note. ^aToolset ("factor" or "component" in factor analysis): 1—Planning/Controlling; 2—Planning/Executing; 3—Planning/Closing; 4—Planning/Initiating
Dark gray shaded: The item dealt with the respective column toolset.

Light gray shaded: Although the item has slightly loaded higher in the respective column toolset, it dealt with the column toolset shaded in dark gray.

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References

- Abrahamson, E. (1991). Managerial fads and fashions: The diffusion and rejection of innovations. *Academy of Management Review*, 16(3), 586–612. Retrieved from <http://doi.org/10.5465/AMR.1991.4279484>
- Abrahamson, E., & Fairchild, G. (1999). Management fashion: Life-cycles, triggers, and collective learning processes. *Administrative Science Quarterly*, 44(4), 708–740. Retrieved from <http://doi.org/10.2307/2667053>
- Andersen, E. S., & Vaagaasar, A. L. (2009). Project management improvement efforts-creating project management value by uniqueness or mainstream thinking? *Project Management Journal*, 40(1), 19–27. Retrieved from <http://doi.org/10.1002/pmj.20096>
- Association for Project Management (APM). (2012). *APM body of knowledge*. Buckinghamshire, UK: Association for Project Management.
- Atkinson, R., Crawford, L., & Ward, S. (2006). Fundamental uncertainties in projects and the scope of project management. *International Journal of Project Management*, 24(8), 687–698. Retrieved from <http://doi.org/10.1016/j.ijproman.2006.09.011>
- Badewi, A. (2016). The impact of project management (PM) and benefits management (BM) practices on project success: Towards developing a project benefits governance framework. *International Journal of Project Management*, 34(4), 761–778. Retrieved from <http://doi.org/10.1016/j.ijproman.2015.05.005>
- Baguley, T. (2004). Understanding statistical power in the context of applied research. *Applied Ergonomics*, 35(2), 73–80. Retrieved from <http://doi.org/10.1016/j.apergo.2004.01.002>
- Barber, E. (2004). Benchmarking the management of projects: A review of current thinking. *International Journal of Project Management*, 22(4), 301–307. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0263786303000899>
- Besner, C., & Hobbs, B. (2006). The perceived value and potential contribution of project management practices to project success. *Project Management Journal*, 37(3), 37–48.
- Besner, C., & Hobbs, B. (2008). Project management practice, generic or contextual: A reality check. *Project Management Journal*, 39(1), 16–33. Retrieved from <http://doi.org/10.1002/pmj.20033>
- Besner, C., & Hobbs, B. (2012a). An empirical identification of project management toolsets and a comparison among project types. *Project Management Journal*, 43(5), 24–46. Retrieved from <http://doi.org/10.1002/pmj.21292>
- Besner, C., & Hobbs, B. (2012b). *Contextualization of project management practice and best practice*. Newtown Square, PA: Project Management Institute.
- Besner, C., & Hobbs, B. (2013). Contextualized project management practice: A cluster analysis of practices and best practices. *Project Management Journal*, 44(1), 17–34. Retrieved from <http://doi.org/10.1002/pmj.21291>
- Bollen, K. A. (2014). *Structural equations with latent variables*. Wiley Series in Probability and Statistics. Hoboken, NJ: Wiley.
- Chuan, C. L. (2006). Sample size estimation using Krejcie and Morgan and Cohen statistical power analysis: A comparison. *Jurnal Penyelidikan IPBL*, 7, 78–86.
- Cohen, J. (1992). Quantitative methods in psychology. *Psychological Bulletin*, 112(1), 155–159.
- Cooke-Davies, T. J. (2001). *Towards improved project management practices: Uncovering the evidence for effective practices through empirical research*. Leeds, UK: Leeds Metropolitan University.
- Cooke-Davies, T. J., Crawford, L. H., & Lechler, T. G. (2009). Project management systems: Moving project management from an operational to a strategic discipline. *Project Management Journal*, 40(1), 110–123.
- Crawford, L., Hobbs, B., & Turner, J. R. (2005). *Project categorization systems: Aligning capability with strategy for better results*. Newtown Square, PA: Project Management Institute.
- Dey, P. (2002). Benchmarking project management practices of Caribbean organizations using analytic hierarchy process. *Benchmarking: An International Journal*, 9(4), 326–356. Retrieved from <http://www.emeraldinsight.com/doi/abs/10.1108/14635770210442680>
- Elmuti, D., & Kathawala, Y. (1997). An overview of benchmarking process: A tool for continuous improvement and competitive advantage. *Benchmarking: An International Journal*, 4(4), 229–243. Retrieved from <http://doi.org/10.1108/14635779710195087>
- Eskero, P., & Riis, E. (2009). Project management models as value creators. *Project Management Journal*, 40(1), 4–18. Retrieved from <http://doi.org/10.1002/pmj.20098>
- Fabrigar, L. R., MacCallum, R. C., Wegener, D. T., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, 4(3), 272–299. Retrieved from <http://doi.org/10.1037/1082-989X.4.3.272>
- Fernandes, G., Ward, S., & Araújo, M. (2013). Identifying useful project management practices: A mixed methodology approach. *International Journal of Information Systems and Project Management*, 1(4), 5–21. Retrieved from <http://doi.org/10.12821/ijispm010401>
- Fernandes, G., Ward, S., & Araújo, M. (2014). Developing a framework for embedding useful project management improvement initiatives in organizations. *Project Management Journal*, 45(4), 81–108. Retrieved from <https://doi.org/10.1002/pmj.21441>
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. London, England: Sage Publications.
- Flora, H. K., & Chande, S. V. (2014). A systematic study on agile software development methodologies and practices. *International Journal of Computer Science and Information Technologies*, 5(3), 3626–3637.
- Gaddis, P. O. (1959). The project manager. *Harvard Business Review*, 37(3), 89–97.

- Hill, M. M., & Hill, A. (2008). *Investigação por questionário* (2nd ed.). Lisboa, Portugal: Edições Sílabo.
- Hobbs, B., Aubry, M., & Thuillier, D. (2008). The project management office as an organisational innovation. *International Journal of Project Management*, 26(5), 547–555. Retrieved from <http://doi.org/10.1016/j.ijproman.2008.05.008>
- Hodgson, D. (2002). Disciplining the professional: The case of project management. *Journal of Management Studies*, 39(6), 803–821. Retrieved from <http://doi.org/10.1111/1467-6486.00312>
- Ibbs, C. W., & Kwak, Y. H. (2000). Calculating project management's return on investment. *Project Management Journal*, 31(2), 38–47.
- IBM. (2012). *SPSS—Statistical product and service solution* (Version 21). IBM. Retrieved from <https://www.ibm.com/analytics/spss-statistics-software>
- INE. (2014). *Instituto Nacional de Estatística (Statistics Portugal)*. Retrieved from <http://smi.ine.pt/Versao>
- International Project Management Association (IPMA). (2015). *Individual competence baseline for project, programme and portfolio management*. International Project Management Association. Retrieved from <https://www.ipma.world/individuals/standard/>
- Jha, K. N., & Iyer, K. C. (2007). Commitment, coordination, competence and the iron triangle. *International Journal of Project Management*, 25(5), 527–540. Retrieved from <http://doi.org/10.1016/j.ijproman.2006.11.009>
- Joslin, R., & Müller, R. (2015). Relationships between a project management methodology and project success in different project governance contexts. *International Journal of Project Management*, 33(6), 1377–1392. Retrieved from <http://dx.doi.org/10.1016/j.ijproman.2015.03.005>
- Kerzner, H. (2015). *Project management best practices: Achieving global excellence*. Hoboken, NJ: John Wiley & Sons.
- Kerzner, H. (2017). *Project management—A systems approach to planning, scheduling and controlling* (10th ed.). Hoboken, NJ: John Wiley & Sons, Inc.
- Kim, J.-O., & Mueller, C. W. (1978). *Factor analysis: Statistical methods and practical issues. Quantitative applications in the social sciences*. Beverly Hills, CA and London, England: Sage Publications.
- Kline, P. (1994). *An easy guide to factor analysis*. London, England: Routledge.
- Kwak, Y. H., & Anbari, F. T. (2009). Availability-impact analysis of project management trends: Perspectives from allied disciplines. *Project Management Journal*, 40(2), 94–103. Retrieved from <http://doi.org/10.1002/pmj.20111>
- Lappe, M., & Spang, K. (2014). Investments in project management are profitable: A case study-based analysis of the relationship between the costs and benefits of project. *International Journal of Project Management*, 32(4), 603–612. Retrieved from <https://doi.org/10.1016/j.ijproman.2013.10.005>
- Loo, R. (2002). Working towards best practices in project management: A Canadian study. *International Journal of Project Management*, 20(2), 93–98. Retrieved from [http://doi.org/10.1016/S0263-7863\(00\)00042-9](http://doi.org/10.1016/S0263-7863(00)00042-9)
- Luu, V. T., Kim, S.-Y., & Huynh, T.-A. (2008). Improving project management performance of large contractors using benchmarking approach. *International Journal of Project Management*, 26(7), 758–769.
- Marchewka, J. T. (2015). *Information technology project management*. Hoboken, NJ: John Wiley & Sons.
- Maylor, H., Brady, T., Cooke-Davies, T., & Hodgson, D. (2006). From projectification to programmification. *International Journal of Project Management*, 24(8), 663–674. Retrieved from <http://doi.org/10.1016/j.ijproman.2006.09.014>
- Mengel, T., Cowan-Sahadath, K., & Follert, F. (2009). The value of project management to organizations in Canada and Germany, or do values add value? Five case studies. *Project Management Journal*, 40(1), 28–41. Retrieved from <http://doi.org/10.1002/pmj.20097>
- Mir, F. A., & Pinnington, A. H. (2014). Exploring the value of project management: Linking project management performance and project success. *International Journal of Project Management*, 32(2), 202–217. Retrieved from <http://10.1016/j.ijproman.2013.05.012>
- Papke-Shields, K. E., Beise, C., & Quan, J. (2010). Do project managers practice what they preach, and does it matter to project success? *International Journal of Project Management*, 28(7), 650–662. Retrieved from <http://doi.org/10.1016/j.ijproman.2009.11.002>
- Patanakul, P., & Iewwongcharoen, B. (2010). An empirical study on the use of project management tools and techniques across project life-cycle and their impact on project success. *Journal of General Management*, 35(3), 41–66.
- Peng, G., Junwen, F., & Huating, W. (2007). Development and comparative analysis of the project management bodies of knowledge. *Management Science and Engineering*, 1(1), 106–111.
- Pinto, R., & Dominguez, C. (2012). Characterization of the practice of project management in 30 Portuguese metalworking companies. *Procedia Technology*, 5, 83–92.
- Project Management Association of Japan (PMAJ). (2005). *A guide-book of project & program management for enterprise innovation* (Vol. 1). Tokyo, Japan: Project Management Association of Japan.
- Project Management Institute (PMI). (2017). *A guide to the project management body of knowledge (PMBOK® guide)* – Sixth edition. Newtown Square, PA: Author.
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed.). London, England: Pearson.
- Söderlund, J. (2011). Pluralism in project management: Navigating the crossroads of specialization and fragmentation. *International Journal of Management Reviews*, 13(2), 153–176. Retrieved from <http://doi.org/10.1111/j.1468-2370.2010.00290.x>
- The Standish Group. (2015). *Chaos manifesto 2015*. The Standish Group International, Incorporated. Retrieved from <https://www.infoq.com/articles/standish-chaos-2015>
- Thomas, J., & Mullaly, M. (2008). *Researching the value of project management*. Newtown Square, PA: Project Management Institute.
- Turner, R. (2014). *Handbook of project-based management* (4th ed.). New York, NY: McGraw-Hill Education.
- White, D., & Fortune, J. (2002). Current practice in project management—An empirical study. *International Journal of Project Management*, 20(1), 1–11.
- Whitty, S. J. (2005). A memetic paradigm of project management. *International Journal of Project Management*, 23(8), 575–583. Retrieved from <http://doi.org/10.1016/J.IJPROMAN.2005.06.005>

- Wideman, R. M. (2002). *Wideman comparative glossary of common project management terms* (Version 3.1). Retrieved from <http://maxwideman.com/pmglossary/>
- Zhai, L., Xin, Y., & Cheng, C. (2009). Understanding the value of project management from a stakeholder's perspective: Case study of mega-project management. *Project Management Journal*, 40(1), 99–109. Retrieved from <http://10.0.3.234/pmj.20099>
- Zwikaël, O. (2009). The relative importance of the *PMBOK®* guide's nine knowledge areas during project planning. *Project Management Journal*, 40(4), 94–103. Retrieved from <http://doi.org/10.1002/pmj.20116>
- Zwikaël, O., & Ahn, M. (2011). The effectiveness of risk management: An analysis of project risk planning across industries and countries. *Risk Analysis*, 31(1), 25–37. Retrieved from <http://doi.org/10.1111/j.1539-6924.2010.01470.x>
- Zwikaël, O., & Globerson, S. (2006). From critical success factors to critical success processes. *International Journal of Production Research*, 44(17), 3433–3449. Retrieved from <http://doi.org/10.1080/00207540500536921>

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