# Project Management Practices in Private Organizations

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**ABSTRACT**

This paper aims to make a contribution to theory, as well as to practice, by identifying which 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 Meeting, Activity List, Progress Meetings, Gantt Chart and Baseline Plan, 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 (Kwak & Anbari, 2009; Zhai, Xin, & Cheng, 2009). However, project management remains a highly problematical endeavor. The Standish Group International Chaos Manifesto 2013 shows that, in the information and technology (IT) sector of activity, in 2012, only 39% of all the projects surveyed succeeded (i.e. were delivered on time, on budget, with the required features and functions); 43% were challenged (late, over budget and/or with less than the required

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features and functions) and 18% failed (cancelled 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 (SGI, 2013).

According to Kerzner (2014), best project management practices lead to added business value, greater benefit realization, and better benefits 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 (Ibbs & Reginato, 2002; Thomas & Mullaly, 2008; Zhai *et al.*, 2009). These authors show 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 clients' satisfaction (Andersen & Vaagaasar, 2009; Eskerod & Riis, 2009; Mengel, Cowan-Sahadath, & Follert, 2009).

Project management bodies of knowledge[2] (BOK) are used by practitioners as 'best practice' guides to what the project management discipline comprises. There has been an emergence of multiple BOKs/standards such as: PMBoK® from Project Management Institute (PMI, 2013), APM BOK from Association for Project Management (APM, 2012), ICB3.0 from International Project Management Association (IPMA, 2006), and P2M from Project Management Association of Japan (PMAJ, 2005). The attempts by the BOKs to systematize the knowledge required to manage projects are largely based on the underlying assumption that there are identifiable patterns and generalizations, from which rules, controls and guidelines for 'best practice' can be established that are replicable, even if not on every circumstance. The PMBoK® (PMI, 2013), APM BOK (APM, 2012) and P2M (PMAJ, 2005) are of the most

[2] The 'Project management body of knowledge' is the sum of knowledge within the profession of project management. The complete project management body of knowledge (BOK) 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).

influential publications on what constitutes the knowledge base of the profession (Morris, Jamieson, & Shepherd, 2006). The three are not inconsistent; however the APM BOK and P2M are much wider in conceptual and scope terms than the PMI PMBoK® (Morris, Crawford, Hodgson, Shepherd, & Thomas, 2006).

Although, the project management paradigm is surprisingly well defined through generic bodies of knowledge, it is well accepted that project management is highly contingent on the organizational context[3], such as structure of business or sector, size, and its environment (Besner & Hobbs, 2008, 2012a, 2012b; Cooke-Davies, Crawford, & Lechler, 2009; Hobbs, Aubry, & Thuillier, 2008; Zwikael, 2009). However, for example the PMBoK® recognized that "*'Good practice' does not mean that the knowledge described should always be applied uniformly to all projects; the organization and/or project management team is responsible for determining what is appropriate for any given project*" (PMI, 2013, p. 2).

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 a 'misfit' between specific project characteristics and the chosen management approach is seen as a major source for project failure.

According to Besner and Hobbs (2013, p. 17) "*Three of the limitations of the project management bodies of knowledge/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*

[3] The organizational context is dependent on the strategic context, as well as the economic, political and cultural context and organizational attributes (e.g. organizational structures; project data; organizational culture and people who actually do the work in organizations) (Thomas & Mullaly, 2008).

*to the context but do not provide indications of what this adaptation might be*". The research reported in this paper aims to contribute to these current shortcomings in the literature and standards, specifically by addressing the following research questions:

1. What are most used project management practices in private organizations?
2. How the set of 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 paper aims to make a contribution to help organizations identify the practices most used by similar organizations (as a benchmark) and define, based on this knowledge, priorities for selecting practices that can be implemented in their own organizations. Hereupon, it also intends to provide guidance on these issues to institutions that teach and train project management.

Benchmark has several advantages, for example, it encourages a culture of continuous improvement in project management, it can utilize new ideas of proven practices, it may generate a higher level of commitment, it can lead to the discovery of radically different approaches to the same problems, it prevents the company from being only internally focused, and the company can develop a concrete understanding of competition (Barber, 2004; Dey, 2002; Luu, Kim, & Huynh, 2008), and by doing so, 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 seen as those tools and techniques that practitioners use to "execute a project management process", such as Work Breakdown Structure or Project Charter. Tools and techniques are closer to the day-to-day practice, closer to the things people do, closer to their tacit knowledge (Besner & Hobbs, 2008).

Recently, Fernandes, Ward and Araújo (2013) have conducted a similar research, but instead

of the most used project management practices, they studied the most useful project management practices, i.e. the project management practices that have high level of benefit to project management performance[4]. 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 subjective to 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, while 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, since 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 also 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 leading-edge.

Nevertheless, this study focuses on a survey of the actual project management practices in private organizations, since 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

[4] Project management performance is focused to the triple constraints: control of time, cost and progress of the project (Jha & Iyer, 2007).

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 2339 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 where the clusters were called contextual archetypes. These archetypes of contextualized practice are 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: i) the characteristics of established quantitative and qualitative objective(s); ii) a set of activities that are complex enough to need managing (uniqueness); and iii) 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 project has been broadened from an initial focus on management of largely unitary/standalone projects with well-defined and agreed goals and end products, to include multiple projects and programs that are multidisciplinary, and which are not pre-defined but permeable, contested and open to renegotiation throughout (Atkinson, Crawford, & Ward, 2006).

In this study, it was adopted the traditional view, defining a project as a temporary endeavor in which human, material and financial resources are organized in a novel way to create a unique product, service or result (PMI, 2013). A project is comprised by a set of defined deliverables, the scope to fulfill the project's objectives (IPMA, 2006), 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 from project management professional organizations; however they all specify the same concept. For example, the Association for Project Management (APM, 2012, p. 2) defines project management as *"a process by which projects are defined, planned, monitored, controlled and delivered such that the agreed benefits are realized"*. 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 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, since their use may not have the same effect for different organizations. Therefore, project management 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 the needs of each one (PMI, 2013). As Crawford, Hobbs and Turner (2005, p. 13) stated about the project management approach, "*…there was greater success when procedures were tailored to project type than when a common approach was used*".

There are various standards and methodologies documenting project management practices, which may give guidance to develop tailored project management processes. The most referred in the literature are: PMBoK from Project Management Institute (PMI, 2013), PRINCE2 from

Office of Government Commerce (OGC, 2009), APM BOK from the Association for Project Management (APM, 2012), ICB from the International Project Management Association (IPMA, 2006) and P2M from the Project Management Association of Japan (PMAJ, 2005).

*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).

In this study the project management practices referred on the most internationally recognized standard, the PMBoK, from Project Management Institute (PMI, 2008), were considered. Project Management Institute is an American non-profit organization founded in 1969. PMBoK defines guidelines for Project Management that aim to promote and expand knowledge in this area. The PMBoK version used in this study was the fourth edition, which identifies nine knowledge areas: integration management, scope management, time management, cost management, quality management, communication management, human resources management, procurement management and risk management. According to Marchewka (2014), the ones considered the most important are the scope, time, cost and quality management areas, which correspond to the main objectives of project management. PMBoK in its fifth edition, incorporated a new area of knowledge - stakeholders management, and instead of 42 processes, it presented 47 processes (PMI, 2013).

A study conducted in 30 metalworking companies in Portugal revealed that the management practices were valued for the nine knowledge areas, being considered as the most important the scope management and the procurement management, and the least important the risk

management and the integration management. This study was done through questionnaires. The study also revealed that the majority of the projects considered did not achieve the desired results. Practices related to planning of activities, human resources, costs and communications were considered the most important ones (Pinto & Dominguez, 2012).

Specific empirical studies have been conducted which 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 how effective the methods and techniques used are felt to be. 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 text books of project management (e.g. Kerzner, 2009). 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 in 2004 by Besner and Hobbs (2006) analyzed usage of 70 tools and techniques, for 753 respondents. Besner and Hobbs found that 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 survey, in decreasing order by the level of usage, from top to bottom and left to right.

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

**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 |
| | 30. Team Building Event | 53. Bidders Conferences |
| **4. Gantt Chart** | 31. Work Authorisation | 54. Learning Curve |
| 5. Project Scope Statement | 32. Self-directed Work Teams | 55. Parametric Estimating |
| 6. Milestone Planning | 33. Ranking of Risks | 56. Graphic Presentation of Risk Information |
| 7. Change Request | 34. Financial Measurement Tools | 57. Life Cycle Cost |
| 8. Requirements Analysis | 35. Quality Plan | 58. Database of Contractual Commitment Data |
| 9. Work Breakdown Structure | 36. Bid Documents | |
| 10. Statement of Work | 37. Feasibility Study | 59. Probabilistic Duration Estimate (PERT) |
| 11. Activity List | 38. Configuration Review | 60. Quality Function Deployment |
| **12. Project Management Software for Monitoring Schedule** | 39. Stakeholders Analysis | 61. Value Analysis |
| | 40. Project Management Software for Resource Levelling | 62. Database of Risks |
| 13. Lessons Learned | | 63. Trend Chart or S-curve |
| 14. Baseline Plan | 41. Project Management Software for Monitoring Cost | 64. Control Charts |
| 15. Client Acceptance Form | | 65. Decision Tree |
| 16. Quality Inspection | 42. Network Diagram | 66. Cause-and-effect Diagram |
| 17. **Project Management Software for Resource Scheduling** | 43. Project Communication Room (War Room) | 67. Critical Chain Method |
| | 44. Project Website | 68. Pareto Diagram |
| 18. Project Charter | 45. Bid/Seller Evaluation | 69. Project Management Software for Simulation |
| 19. Responsibility Assignment Matrix | 46. Database of Historical Data | |
| 20. Customer Satisfaction Surveys | 47. Project Management Software for Multiproject Scheduling/Levelling | 70. Monte Carlo Analysis |
| 21. Communication Plan | | |
| 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** | | |

Besner and Hobbs, based on continuing their process of data collection from 2004, collected data in another two phases (2007, and 2009). Later, Besner and Hobbs (2012a) 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; information technology (IT) and telecommunications projects; and software development projects. Besner and Hobbs (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' 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; multi criteria project selection or project management software for project portfolio analysis), which is beyond the scope of this research study, focused in the management of individual projects. Therefore, the present study uses as a reference the work developed by

Besner and Hobbs (2006).

## 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 collecting a great amount of data in a non-expensive way. The other advantages of using this research method are: reach out for several organizations simultaneously, obtain data fast, and collect a broad variety of data which is easy to explain and understand.

There are several ways of running a questionnaire: by phone, paper, email, etc. For this study, we choose 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 nine knowledge areas of PMBoK (PMI, 2008). The choice of the tools and techniques came from a cross-checking of papers and studies published by different authors such as Besner and Hobbs (2006), Fernandes *et al.* (2013), Papke-Shields, Beise, and Quan (2010) and White and Fortune (2002).

However, as referred above, the work that had more influence in the selection was Besner and Hobbs (2006).

Of the 70 tools and techniques of Besner and Hobbs (2006) study, 15 were also in the study of Papke-Shields et al. (2010) and 10 in the study of White and Fortune (2002). From the Besner and Hobbs (2006) study, 68 tools and techniques were selected. Project Management Software for Multi-Project Scheduling / Leveling were excluded because they were related to portfolio management, and Risk Management Documents was divided into Risk Identification, Qualitative Risk Analysis and Quantitative Risk Analysis, giving a total of 71 tools and techniques. Other 8 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.

**Table 2. The 79 project management tools and techniques surveyed by 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 | Lesson 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 Levelling | Work Breakdown Structure |
| Earned Value Management | Project Management Software for Resource Scheduling | |
| Feasibility Study | Project Management Software for Simulation | |

The questionnaire 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; 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. This data was collected to allow to describe the sample and also to perform analysis of the differences between sectors of activity, organizational dimensions and organizational strategies. Also several relations were studied to identify which factors have influence on project management practices usage such as age, gender, level of education, position or experience. For example, it was expected that people with more years of experience or higher level of education would have a more extensive use of project management practices.

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

Since project management is applied in different activity sectors, the following were selected for this study, as defined 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 – 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 of Besner and Hobbs (2006).

A pre-test was done to verify its usability, understanding, length and clarity. To perform this test, a convenience sample was used. The understanding and time required to complete the questionnaire was also accessed. 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). Due to personal privileged access, the researchers asked the two Portuguese Management Associations (PMI Portugal Chapter and APOGEP) to advertise the survey to their members and ask them to send it also to their colleagues. During the period, a total of 159 responses were received. The answers were then imported into the database of the statistical software SPSS (IBM, 2012).

According to Hill and Hill (2008), 100 respondents is the minimum sample size recommended for the application of a certain statistical technique. Chuan (2006) suggest the Cohen Statistical Power Analysis to sample size estimation. On this regard, Baguley (2004) based on Cohen (1992) guidelines, suggests the use of a conventional level of significance of 0.05 and a sample size of 85 participants. Therefore, it was considered that a sample size of 159 respondents was adequate to validate the obtained results.

To obtain the twenty most used project Management tools and techniques the 79 surveyed were ranked by descending order according to the percentage of use.

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

a Kruskal-Wallis test was used. The Mann-Whitney U test helped to 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 (FA) was also conducted to study the relation between the top 20 most used project management practices identified. FA is a collection of methods used to study the interrelationships among component variables (Fabrigar, MacCallum, Wegener, & Strahan, 1999). As stated by Bollen (2014), FA 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 FA, a Bartlett's test of sphericity and a Kaiser-Meyer-Olkin (KMO) test were conducted in order to assess the factorability of the data. Barlett's test of sphericity should be $p < 0.5$ to be significant; whereas KMO index ranges from 0 to 1. FA is assumed to be appropriate if KMO is higher than 0.6, although 0.7 and 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 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 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 the 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 had less than 30 years old, a vast majority had between 30 and 49 years old (80,4%) and 13.3% were older than that.

Regarding the professional seniority (or experience), approximately half of the sample had less than 10 years of experience in project management, 32.2% had between 10 to 15 years of experience; in turn, 17.6% had more than 15 years of experience in this field. Most of them held a project manager position (57.2%) while about 16.4% were directors; program-managers and portfolio-managers positions were reported by 9.4% of the respondents; 5.7% held a manager position; about 5% of them were members of the project team; and a different position was reported by 6.3% of the respondents. Results showed that the higher hierarchical positions were occupied by senior 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 expectable. Indeed, as it is possible

to observe in Figure 1, for example, the director position was held in majority by people aged above 50 years, while the project manager position was held, in majority, by younger people.

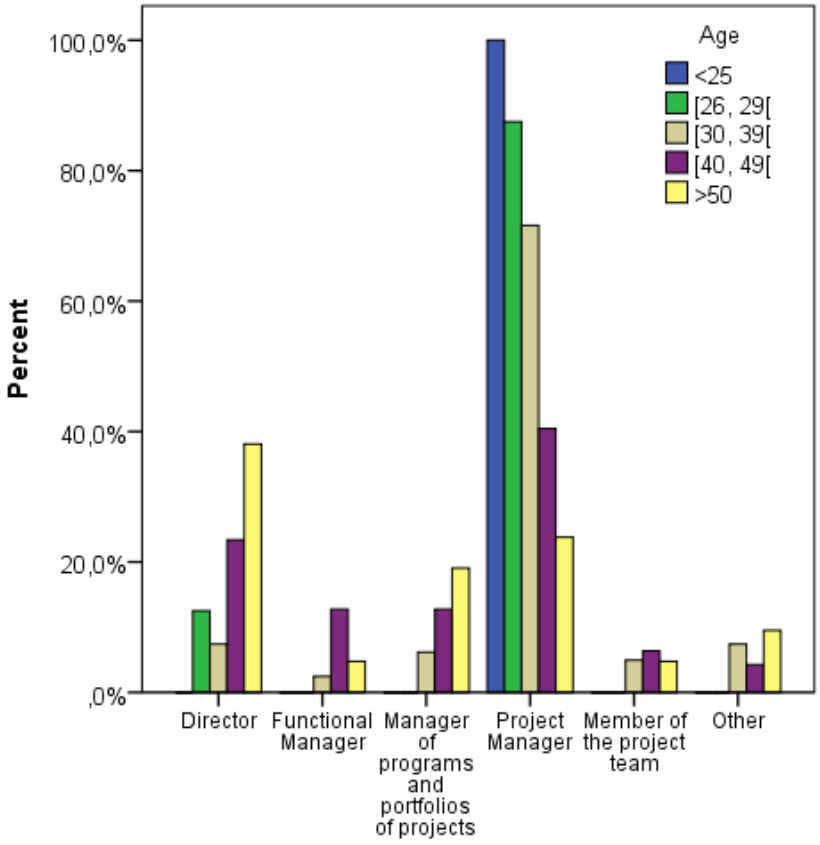


**Figure 1. Age distribution of respondents by current position**

Most of the respondents received a graduation education (36.5%), 32.1% received a postgraduate degree, 24.5% had a master degree, while 3.1% had a doctors' degree. About 1.9% of the respondents received a under graduate technical education and the rest (1.9%) did not specified the type of education.

The most representative sectors of activity were the ones corresponding to the Information and Communication (48.4%), and the Services sector with 20.1%, followed by the Manufacturing sector, with 11.3%. With lower percentage (7.5%) was the Construction sector. About 12.7% of the respondents did not specified the sector of activity.

*Most Used Project Management Practices*

For answering the first research question: "What are most used project management practices in private organizations?", the 79 Project Management (PM) tools and techniques surveyed were ranked by descending order, and the 20 most used are emphasized in Table 3.

**Table 3. The 79 project management tools and techniques ranked by usage 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 | 61Life 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 |
| V11Requirements 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 Lesson 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 Levelling | 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 | |

Regarding the twenty tools and techniques, the occupied position in our study is presented by process groups as follows: (1) ***Initiating Process Group***: Kick-off Meeting and Project Charter (first and sixteenth position, respectively); (2) ***Planning Process Group***: Work Breakdown Structure (ninth position); Requirements Analysis (eleventh position); Project Scope Statement (thirteenth position); Baseline Plan (fifth position); Activity List, Gantt Chart and Milestone Planning (second, fourth and eighth position, respectively); Risk Identification (ninetieth position); (3) ***Executing Process Group***: Project Issue Log and Lesson Learned (fifteenth and eighteenth position respectively); (4) ***Monitoring and Controlling Process Group***: Progress Meetings, Progress Report, Change Request, Project Management Software for Monitoring Schedule and Customer Satisfaction Surveys (third, sixth, twelfth, twenty and fourteenth positions respectively) and (5) ***Closing Process Group***: Client Acceptance Form, Project

Closure Documentation and Close Contracts (seventh, tenth and seventeenth position respectively).

The top twenty of the 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 twenty covers 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 areas of knowledge: integration, scope and time assume a high relevance amongst the most useful project management practices, each with at least three project management practices on the top of the list. For example, under the scope management practices were identified: Requirements Analysis, Project Scope Statement and Work Breakdown Structure. Curiously, none of the tools from the area of cost or quality, related usually to the project's objectives, were in the top of the list.

Based on the Besner and Hobbs (2006) study, a comparative analysis was performed. The twenty tools and techniques most used by the private organizations (Table 3) were compared with the top twenty most used in Besner and Hobbs (2006). Both studies have in common the use of fifteen of the twenty tools (see Table 4). Notice that the Gantt Chart and the Work Breakdown Structure had exactly the same position 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 twenty, 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 (third position).

**Table 4. Studies comparison of the 20 most used tools and techniques**

| Tool and Technique | Position in our study | Position in the study of Besner and Hobbs (2006) |
|---|---|---|
| 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 | - |
| Lesson Learned | 18 | 13 |
| Risk Identification | 19 | - |
| Project Management Software for Monitoring Schedule | 20 | 12 |

Remark: 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

*Most Used Project Management Practices: by sector of activity*

The second research question of the study was: "How the set of most used project management practices vary in different sectors of activity?". Taking into consideration the distribution of the results per 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, Zwikael and Ahn (2011) demonstrated that the intensity of use of risk management processes are dependent on industry activity.

Results showed that the 79 tools and techniques are used in the four activities' sectors. However, and after comparing the results, it was found that there is always a sector which uses more a particular tool or technique than the others. For example, the Project Charter is more used in the Information and Communication sector (62.4%), followed by the Manufacturing sector (61.1%) and by the Services sector (59.4%). The Project Charter is less used by the Construction sector, with 41.7%.

In this study, Services sector was the sector who 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 uses 18 while the Information and Communication sector uses 14 of the total ones. Generally, in terms of frequency of use, results showed that, on average, the sector which more often uses the project management tools and techniques is the Services sector followed by the Manufacturing sector and the Information and

Communication sector. The sector which uses less frequently the project management tools and techniques is the Construction sector. So, all the 79 tools and techniques are used in the four activities sectors but with different frequency.

Considering the 159 obtained responses, the top ten most used tools and techniques by activity sector (colored by process groups) are presented in Table 5.

**Table 5. Top ten most used project management tools and techniques by activity sector colored 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-ten list, the only tool and technique of the Initiation group is the Kick-off Meeting. Oddly, this tool is not in the top ten most used tools, considering the responses of the Construction sector.

Notice that the most representative Process Group of 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 of the study are aligned with the study of Zwikael and Globerson (2006), which have concluded that these identified most used practices, activity list and plan, are also important practices to project success, showing in this case that the most used project management practices are also the ones that have greatest impact on project performance.

Results also highlighted that Bid/Seller Evaluation is the unique tool and technique of the Executing Process Group represented in the top-ten, and it is represented only in the Manufacturing sector, although, it would be expectable to find it also in the Construction sector. As expected, by observing the Closing Process Group, the Close Contracts is one of the top ten tools and techniques used by the Construction sector, as it is the sector that usually most uses subcontracting.

*Most used Project Management Practices: respondents' characteristics influence*

The third research question was: "Do the respondents' characteristics influence the use of project management practices?". The influence of the gender, the age, the professional seniority, the education level and the current position on the tools and techniques selection was also analyzed. Due to the fact that the variables under analysis are discrete, a study on the chi-square test ($\chi 2$) was accomplished. 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 influence on the tools' selection ($p>0.05$) except for 15 of the 79 tools and techniques, namely: Project Statement of Work, Bid Documents, Design of Experiments, Parametric Estimating, PM Software for Cost Estimating, PM Software for Resource Levelling, PM Software for Resource Scheduling, PM Software for Task Scheduling, Quantitative Risk Analysis, Quality Function Deployment, Team Member Performance Appraisal, Work Authorization, Cause-and-effect Diagram, PM Software for Monitoring Cost and PM Software for Monitoring Schedule. 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 influence on the selection of 21 of the total analyzed tools and techniques ($p<0.001$): Feasibility Study, Financial Measurement Tools, Handover (from the proposal team to the project team), Cost-benefit Analysis, Database of Contractual Commitment Data, Database for Cost Estimating, Database of Historical Data, Database of

Lessons Learned, Decision Tree, Monte Carlo Analysis, Project Management Software for Simulation, Top-down Estimating, Bidders Conferences, Bid/Seller Evaluation, Team Member Performance Appraisal, Work Authorization, Cause-and-effect Diagram, Configuration Review, Pareto Diagram, Project Closure Documentation and Customer Satisfaction Surveys. Results obtained seem to indicate that the professional seniority has influence on the tools and techniques selection ($p<0.001$) as well as 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, e.g. Feasibility Study, Baseline Plan, Top-down Estimating, Bidders Conferences, Cause-and-effect Diagram, and Client Acceptance Form, just to mention some. Regarding the current position of the respondents, significant results were found in just 8 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, this influence is more significant as higher is the position of the respondents. As an example, those respondents who have Director positions preferentially selected the Feasibility Study [Mdn for director position = 101.77] and the Project Scope Statement [Mdn director = 91.00], while the Milestones Planning, the Quantitative Risk Analysis and the Work Breakdown Structure (WBS) were selected by those who have positions of Managers of Programs and Portfolios [Mdn = 105.30; Mdn = 118.30; Mdn = 100.50]. In terms of career, the beginners in project management, that is, those who are Team Members, selected preferentially the Bid/Seller Evaluation, Team Building Event and Pareto Diagram [Mdn = 118.31; Mdn = 110.00; Mdn = 111.50].

The respondents' level of education does not have influence on the tools' selection ($p>0.05$) except for six of the seventy nine 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 who have a PhD degree. The graduated respondents 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 higher level of education. Nevertheless, further studies are required as some of those complex techniques did not present significantly statistical differences regarding the level of education.

Regarding the respondents' characteristics aforementioned, no significant influence was found on the tools and techniques used per activity sector except for the gender ($p<0.05$). None of the other respondents' characteristics (education 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 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 statistic 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 (FA) was conducted to verify the relation between the top 20 most used project management practices identified.

Table 6 summarizes the FA 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, the rotated 'factor' loading matrix and the variance explained for each 'factor' of the 20 most used project management practices is presented.

**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<br>• All data except V1 is suitable for FA |
| | • KMO = 0.880<br>Including V1<br>• KMO = 0.878<br>Excluding V1<br>• KMO decreased 0.002, therefore V1 is maintained for FA<br>• The data set has a "good" level for FA (If 0.8<KMO <0.9) |
| | • Barlett's test of sphericity is significant (p ≈ .000)<br>• The data is factorable |
| | • All items have communalities above the threshold level, except V4 with 0.481, very close to the threshold 0.5<br>• The data shows 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)<br>• A second extraction was run by reducing one 'factor' obtaining a 4-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 4-theme construct was the best option |
| 3. Establishment of the 'factor' (toolset) structure | The 4 theme construct includes 4 'factors' comprising the following variables (see Appendix):<br>• F1: V3, V4, V5, V6, V11, V12, V14, V20<br>• F2: V9, V15, V18, V19<br>• F3: V2, V7, V10, V17<br>• F4: V1, V8, V13, V16 |

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

**Table 7: Reliability analysis - Cronbach's alpha analysis**

| Toolset ('Factor' in FA) | 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 |

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

- ‘Factor’#1 (V3, V4, V5, V6, V11, V12, V14 and V20), although V14 have slightly loaded higher on ‘Factor’#2, dealt with the toolset ‘Planning/Control’;
- ‘Factor’#2 (V9, V15, V18 and V19), represents the toolset ‘Planning/Execution’;
- ‘Factor’#3 (V2, V7, V10 and V17) represents the toolset ‘Planning/Closure; and
- ‘Factor’4 (V1, V8, V13 and V16) represents the toolset ‘Planning/Initiation’.

In summary, the Factor Analysis (FA) led to a four toolset of project management practices. Figure 2 shows the results of the toolset clustering resulting from FA. 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 groups of processes: initiation, execution, monitoring and control, and closing, forming four toolsets: Planning/Initiation toolset (Factor#4); Planning/Execution toolset (Factor#2); Planning/Control toolset (Factor#1); Planning/Closing toolset (Factor#3).

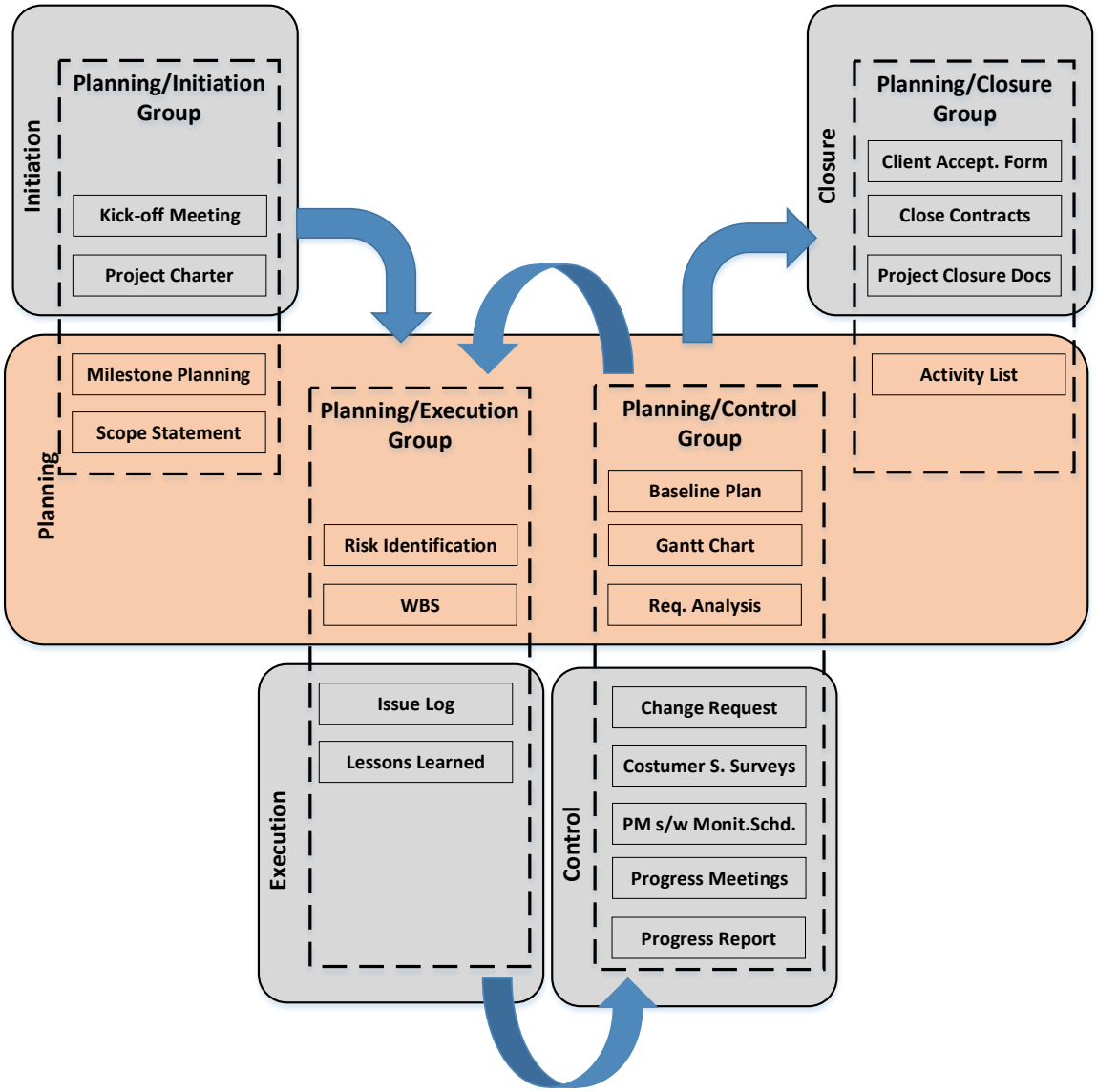


**Figure 2. Project management practices toolset relationships**

The Planning/Initiation 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/Execution (Factor # 2) consists of Risk Identification, WBS, planning tools and techniques, and (Project) Issue Log and Lessons Learned, execution

tools and techniques, although Risk Identification is done throughout the project execution. It is understood that typically one who does a detailed breakdown of the project work, which according to PMBoK is carried out in the process "5.4 Create WBS", has of course 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 WBSs in future projects.

The third toolset, called Planning/Control (Factor # 1), forms the set that has the most tools (40% of the total) and also has a good coherence. The consistency of this group is of course focused on the techniques used in monitoring and control. 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, Baseline Plan being the central element of project planning; (2) the Gantt Chart, although being a planning technique, is widely used for project control, mainly in time control, but also in scope, namely through the use of PM 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, the projects present a great complexity and degree of innovation, with a greater need to re-analyze and follow the requirements - Requirement Analysis; this is also linked to the growing dissemination of some agile practices in project management; (5) related to the management of stakeholder expectations is the Costumer Satisfaction Surveys technique, proposed in the PMBoK process "13.4 Control Stakeholder Engagement".

The fourth toolset, called Planning/Closure, 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). Since in the closure 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 be 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 execution, monitoring and control, and closure, thus forming four toolsets of project management practices.

## CONCLUSIONS

Due to the financial crises the world is facing, it becomes increasingly important for organizations to do better project management. In this regard, it is important that organizations have a better knowledge about the most used project management practices in private organizations, as well as the ones that best fit to 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 with a high level of education, would prefer to implement more complex tools and techniques, such as Quality Functional Deployment and Control Charts.

This paper attempts to answer to four research questions. To obtain the answer for the first research question, (1) "What are 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 by descending order according to the percentage of use (see Table 3). The top twenty of the list of the most useful tools and techniques is composed of very well-known and widely used tools from all phases of the project life cycle, with emphasis on the planning phase. Integration, scope and time were the most represented areas of knowledge on the top list. It was also found that

the top five tools and technique are: Kick-off Meeting, Activity List, Progress Meetings, Gantt Chart and Baseline Plan.

In relation to the second question, (2) “How the set of most used project management practices vary in different sectors of activity?”, it was possible to identify the top ten tools for each sector. Planning process group was, as expected, the most representative group of processes on the top ten tools. It was also important to notice that Activity List and Baseline Plan were in the top ten in all sectors.

In relation to the third question, (3) “Do the respondents’ characteristics influence the use of project management practices?”, it was 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 by age (e.g. Handover, Data Base of Lessons Learned); 15 by gender (e.g. Project Statement of Work, Work Authorization); 39 by professional experience (e.g. Feasibility Study, Baseline Plan); 8 by the current position (e.g. Work Breakdown Structure, Team Building Event) and 6 by level of education (e.g. Quality Functional Deployment, Control Charts). It was also found that senior people and with a higher job experience can have influence on the type of tools and techniques selection.

Finally, for the fourth question, (4) “Are the most used project management practices clustered into groups?”, it was 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 initiation, execution, monitoring and control, and closure, thus forming four toolsets of project management practices: Planning/Initiation toolset; Planning/Execution toolset; Planning/Control toolset; and Planning/Closing toolset. By following a process paradigm with the typical steps of a project (Initiation, Planning, Executing, Monitoring & Control 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, as well as showing some differences across different sectors of activity, as also found by Besner and Hobbs (2008), and project management practitioners' characteristics. For instance, organizations with practitioners with lower lever of education might not adopt more advanced and complex project management tools and techniques, since these practitioners might not have the background knowledge necessary for the use of such tools and techniques.

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, such as PMP, IPMA and others. It would also be interesting to use the presented results on the construction of a decision model regarding the use of different tools and techniques. The model would be based, for example, on type (activity sector) and size of the organizations, as well as on the characteristics of those who are responsible for their implementation, and 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 under the project context, as discussed in this paper, but also by their ease of use, 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 paper, project management practices are clustered into groups, so some practices show high synergies. So, 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 potential new problems and shortcomings of such joint-usage analyses, it is a step in the right direction, already initiated by Besner and Hobbs (2013) and it helps give some new answers to the questions raised by these authors against standards.

## REFERENCES


Abrahamson, E. (1991). Managerial Fads and Fashions: The Diffusion and Rejection of Innovations. *Academy of Management Review*, *16*(3), 586–612. http://doi.org/10.5465/AMR.1991.4279484

Abrahamson, E., & Fairchild, G. (1999). Management Fashion: Lifecycles, Triggers, and Collective Learning Processes. *Administrative Science Quarterly*, *44*(4), 708. 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. http://doi.org/10.1002/pmj.20096

APM. (2012). *APM Body of Knowledge*. 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. 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. 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. 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*. 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. 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. 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. http://doi.org/10.1002/pmj.21291

Bollen, K. A. (2014). Structural Equations with Latent Variables. *Wiley Series in Probability and Statistics*. Hoboken: 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 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. (John R. (2005). *Project categorization systems: aligning capability with strategy for better results*. Project Management Institute.

Dey, P. (2002). Benchmarking project management practices of Caribbean organizations using analytic hierarchy process. *Benchmarking: An International Journal*. 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. http://doi.org/10.1108/14635779710195087

Eskerod, P., & Riis, E. (2009). Project management models as value creators. *Project Management Journal*, *40*(1), 4–18. 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. 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. http://doi.org/10.12821/ijispm010401

Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics*. SAGE Publications.

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.). Edições Sílabo.

Hobbs, B., Aubry, M., & Thuillier, D. (2008). The project management office as an organisational innovation. *International Journal of Project Management*, *26*(5). 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. 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.

Ibbs, C. W., & Reginato, J. (2002). Measuring the strategic value of project management. Retrieved from http://bsun04.bre.polyu.edu.hk/rccree/events/pm_symposium/William_Ibbs.pdf

IBM. (2012). *SPSS - Statistical Product and Service Solution* (Version 21). IBM.

INE. (2014). Instituto Nacional de Estatística (Statistics Portugal). Retrieved from http://smi.ine.pt/Versao

IPMA. (2006). *ICB - IPMA Competence Baseline, Version 3.0. Internacional Project Management Association*.

Jha, K. N., & Iyer, K. C. (2007). Commitment, coordination, competence and the iron triangle. *International Journal of Project Management*, *25*(5), 527–540. http://doi.org/10.1016/j.ijproman.2006.11.009

Kerzner, H. (2009). *Project Management – A Systems Approach to Planning, Scheduling and Controlling* (10th ed.). John Wiley Sons Inc.

Kerzner, H. (2014). *Project management best practices: achieving global excellence*. Wiley.

Kim, J.-O., & Mueller, C. W. (1978). *Factor analysis: statistical methods and practical issues*. *Quantitative applications in the social sciences*. Beverly Hills, CA; London: Sage.

Kline, P. (1994). *An easy guide to factor analysis*. London: 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. http://doi.org/10.1002/pmj.20111

Loo, R. (2002). Working towards best practices in project management: a Canadian study. *International Journal of Project Management*, *20*(2), 93–98. 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. (2014). *Information Technology Project Management*. Wiley.

Maylor, H., Brady, T., Cooke-Davies, T., & Hodgson, D. (2006). From projectification to programmification. *International Journal of Project Management*, *24*(8), 663–674. 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. http://doi.org/10.1002/pmj.20097

Morris, P. W. G., Crawford, L., Hodgson, D., Shepherd, M. M., & Thomas, J. (2006). Exploring the role of formal bodies of knowledge in defining a profession - The case of project management. *International Journal of Project Management*, *24*(8), 710–721. http://doi.org/10.1016/j.ijproman.2006.09.012

Morris, P. W. G., Jamieson, A., & Shepherd, M. M. (2006). Research updating the APM Body of Knowledge 4th edition. *International Journal of Project Management*, *24*(6), 461–473. http://doi.org/10.1016/j.ijproman.2006.02.002

OGC. (2009). *Managing Successful Projects with PRINCE2*. Office of Government Commerce.

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. 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*.

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.

PMAJ. (2005). *A Guidebook of Project & Program Management for Enterprise Innovation* (Volume 1). Project Management Association of Japan.

PMI. (2008). *A Guide to the Project Management Body of Knowledge (PMBoK)* (4th Ed.). Project Management Institute.

PMI. (2013). *PMBOK Guide - A guide to the Project Management Body of Knowledge* (5th Ed.). Project Management Institute.

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research Methods for Business Students* (5th ed.). Education, Pearson, ISBN: 978-0-273-71686-0.

SGI. (2013). *Chaos Manifesto 2013*. The Standish Group International.

Söderlund, J. (2011). Pluralism in Project Management: Navigating the Crossroads of Specialization and Fragmentation. *International Journal of Management Reviews*, *13*(2), 153–176. http://doi.org/10.1111/j.1468-2370.2010.00290.x

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, Fourth Edition*. 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. http://doi.org/10.1016/J.IJPROMAN.2005.06.005

Wideman, R. M. (2002). Wideman Comparative Glossary of Common Project Management Terms v3.1. 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

Zwikael, O. (2009). The relative importance of the PMBOK® Guide's nine Knowledge Areas during project planning. *Project Management Journal*, *40*(4), 94–103. http://doi.org/10.1002/pmj.20116

Zwikael, 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. http://doi.org/10.1111/j.1539-6924.2010.01470.x

Zwikael, O., & Globerson, S. (2006). From Critical Success Factors to Critical Success Processes. *International Journal of Production Research*, *44*(17), 3433–3449. http://doi.org/10.1080/00207540500536921

## APPENDIX

### Table A1. Varimax rotation and variance explained

| Item | Project Management practice | * Toolset ('factor' or 'component' in FA) | | | |
|---|---|---|---|---|---|
| | | 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 | Lesson 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** |
| | **Percent of variance explained** | **19,3%** | **16,6%** | **13,0%** | **10,3%** |

* Toolset ('factor' or 'component' or in FA): 1- Planning/ Control Toolset; 2- Planning/ Execution Toolset; 3- Planning/ Closing Toolset; 4- Planning/ Initiation Toolset