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Identifying useful project management practices: A mixed methodology approach

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Abstract:
This paper describes a mixed methodological research approach for identifying practitioner perceptions of the most useful project management (PM) practices to improve project management performance. By identifying the perceived most useful tools and techniques, as having the most potential for increased contribution to project management performance, practitioners and organizations can select their priorities when improving PM practices. The research involved a programme of thirty interviews with Project Management professionals in Portugal, followed by a global survey. Completed questionnaires were received from 793 practitioners worldwide, covering 75 different countries. The results showed that the top twenty of the list of the most useful tools and techniques is composed of very well-known and widely used tools, such as: progress report; requirements analysis; progress meetings; risk identification; and project scope statement. PM practices in the top of list cover the overall PM life cycle from initiation to project closing, but particular relevance is given to tools and techniques from planning. The areas of knowledge, scope, time, risk, communication and integration, assume a high relevance, each with at least three PM practices on the top of the list.

Keywords:
project management practices; tools and techniques project; project management performance.

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1. Introduction

In the past thirty years project management (PM) has developed substantially as a discipline and significantly increased in visibility [1]-[3]. In order to manage business objectives, organizations are increasingly utilizing the discipline of PM [2],[4]. Business is becoming increasingly 'projectized' or project oriented [5]-[7], and 'management by projects' has become a powerful way to integrate organizational functions and motivate groups to achieve higher levels of performance and productivity [8]. However, demonstrating a concrete value of PM in organizations has been illusive and even paradoxical [9]. There is little research evidence to show that mastery of the PM 'body of knowledge' leads to improved project performance [10]. The actual value resulting from investments in PM has been hard to define and measure [11]. One of the difficulties is to isolate the return from PM and return from other management concepts [12].

Many methods, techniques and tools have been developed, covering all aspects of managing projects from their genesis to their completion [13]. Nevertheless, PM remains a highly problematical endeavor. Projects still fail to live up to the expectations of stakeholders as they continue to be disappointed by projects' results [14]-[17]. For instance, the Standish Group International [17] showed that, in the year 2008, only 32% of all the software projects surveyed succeeded (i.e. were delivered on time, on budget, with required features and functions); 44% were challenged (late, over budget and/or with less than the required features and functions), and 24% of projects failed (cancelled prior to completion or delivered and never used).

The research described in this paper aims to make some contribution in the identification of priorities for organizations when they chose to invest in improving project management performance by the use of specific PM practices. PM practices in this study are simply seen as those tools and techniques that practitioners use to "do the job" to "execute a PM process", such as work breakdown structure or a project charter. Tools and techniques are closer to the day-to-day practice, closer to the things people do, closer to their tacit knowledge [18]. The results presented here are part of a broader research study on the theme improving and embedding PM practices, in which the identification of most useful PM practices is one of five research questions of the study.

2. PM Tools and Techniques

PM tools and techniques are the mechanisms by which PM processes within the organization are delivered and supported. This includes, besides PM techniques (e.g. work breakdown structure or earned value management), the various guidelines in which the processes of the organization are defined, including the use of procedure documents, checklists, job aids, and templates, as well as, the use of software packages and various databases.

The proper use of PM tools and techniques should make it easier to implement PM principles [1]. For example, project management information system (PMIS) identified in the study by White and Fortune [2], as the most used tool and technique, is a tool that supports and facilitates the delivery of any project, particularly those which are complex, subject to uncertainty, and under market, time and money pressures, or other difficult to manage restrictions [3]. As argued by Stewart and Mohamed [4] "Without an effective use of information technology to facilitate the process of information management amongst project participants, it is unlikely that major improvements to the communication process will eventuate by continuing to use traditional paper-based process". Regarding PM software tools the market is populated with a wide range of them [5].

Several inputs can be used to guide an organization in selecting the most appropriate tools and techniques in a given context including various bodies of knowledge. The PM body of knowledge is the sum of knowledge within the profession of PM. The complete PM body of knowledge includes proven traditional practices that are widely applied, as well as innovative practices that are emerging in the profession [6]. The attempts by the bodies of Knowledge 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 absolutely every circumstance [7]. PM Bodies of Knowledge have been published by

the professional PM associations in late 1990´s. There has been an emergence of multiple Bodies of Knowledge, such as:

- PMBoK® from Project Management Institute [8];
- APM BOK from Association for Project Management [9];
- ICB3.0 from International Project Management Association [10]; and
- P2M from Project Management Association of Japan [11].

These bodies of knowledge are used by practitioners as 'Best Practice' guides to what the discipline comprises [12]. The PMBoK®, APM BOK and P2M are of the most influential publications on what constitutes the knowledge base of the profession [13]. The three are not inconsistent, however the APM BOK and P2M, are much broader in conceptual breath and scope than the PMI PMBoK® [12].

Specific empirical studies have been conducted which identified the most used tools, for example the work from White and Fortune [2] and Besner and Hobbs [14]. White and Fortune [2] 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 being considered to participate in the survey. The options chosen to be included in the list were those found in a selection of standard text books of PM (e.g. Kerzner [15]). From an analysis of 236 participants White and Fortune 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%).

A more recent questionnaire survey undertaken in 2004 by Besner and Hobbs [14] surveyed views of 70 tools and techniques, with 753 respondents. Besner and Hobbs found that tools and techniques use levels 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 [14] findings are consistent with the results from White and Fortune [2]. Although, Besner and Hobbs selected a larger number of tools and techniques, the three most used tools identified from White and Fortune are also in the top list of Besner and Hobbs (highlighted a 'bold' in the Table).

Beyond the perceptions of the most used tools and techniques, Besner and Hobbs [14] also studied an interesting variable - the 'intrinsic value of tools', which is the combination of the extent of use of the tools and techniques and the perceived potential contributions to project performance (intrinsic value = present extent of use + potential improvement). For the research study described in this paper, the more relevant information is about the 'intrinsic value' as we are looking for the most useful PM practices. Table 2 lists, from Besner and Hobbs [14], the twenty tools and techniques with the highest 'intrinsic value', in decreasing order from top to bottom and the tools and techniques with the lowest intrinsic value, which were "discredited" by Besner and Hobbs [14] as respondents indicated that these tools were rarely used and were perceived as having very little potential.

Based on continuing their process of data collection from 2004, the data was collected in three phases, in 2004, 2007, and 2009, respectively. In 2012, Besner and Hobbs [31] undertook a further study whose two main objectives were: to demonstrate that practitioners use PM 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; business and financial services; information and technology and telecommunications; and software development projects. Besner and Hobbs [31] 2012 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 and 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 PM software for project portfolio analysis), which is beyond the scope of this research project. Additionally, this later study

did not study the attribute 'intrinsic value' of a tool and technique. Therefore, if any researcher or practitioner is looking for the most useful PM practices to manage a single project it would be better to look for results of the article Besner and Hobbs [29].

Table 1. The 70 tools identified by Besner and Hobbs [1] in decreasing order of level of usage

1. Progress Report	27. Critical path method analysis	50. Database for cost estimating
2. Kick-off meeting	28. Bottom-up estimating	51. Database for lessons learned
3. PM Software to task Scheduling	29. Team member performance appraisal	52. Product breakdown structure
4. Gantt chart	30. Team building event	53. Bidders conferences
5. Scope Statement	31. Work authorisation	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 (LCC)
9. WBS	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. PM software to monitoring schedule	38. Configuration review	61. Value analysis
13. Lessons Learned/Post-mortem	39. Stakeholder analysis	62. Database of risks
14. Baseline plan	40. PM software for resources levelling	63. Trend chart or S-curve
15. Client acceptance form	41. PM software to monitoring of cost	64. Control charts
16. Quality inspection	42. Network diagram	65. Decision tree
17. PM software for resources scheduling	43. Project communication room (war room)	66. Cause-and-effect diagram
18. Project charter	44. Project Web site	67. Critical chain method and analysis
19. Responsibility assignment matrix	45. Bid/seller evaluation	68. Pareto Diagram
20. Customer satisfaction surveys	46. Database of historical data	69. PM software for simulation
21. Communication plan	47. PM software multi-project scheduling/levelling	70. Monte-Carlo analysis
22. Top-down estimating		
23. Risk management documents	48. Earned value	
24. Contingent plans	49. PM software Cost estimating	
25. Re-baselining		
26. **Cost/benefit analysis**		

Table 2. Tools with the highest and lowest 'intrinsic value' identified by Besner and Hobbs [1]

Highest 'intrinsic value'	**Lowest 'intrinsic value'**
1. PM software for task scheduling	1. Life cycle cost
2. Progress report	2. Graphic of risk information
3. Scope statement	3. Parametric estimating
4. Requirements analysis	4. Learning curve
5. Kick-off meeting	5. Quality function Deployment
6. Gantt chart	6. Value analysis
7. Lesson learned/post-mortem	7. Trend chart or S-curve
8. Change request	8. Critical chain method and analysis
9. PM software monitoring schedule	9. Control charts
10. Work breakdown structure	10. PERT analysis
11. Milestone planning	11. Cause-and-effect diagram
12. Statement of work	12. PM software for simulation
13. PM software resources scheduling	13. Pareto diagram
14. Risk management documents	14. Decision tree
15. Activity list	15. Monte Carlo analysis
16. Quality inspection	
17. Baseline plan	
18. Contingency plans	
19. Ranking of risks	
20. Client acceptance form	

3. Research methodology

Attending the research questions and the advantages and disadvantages of the main research methods, the research methodology chosen for this research was a mixed methodology approach, which includes two research instruments: semi-structured interviews and questionnaires. It was expected that the complementary strengths of semi-structured interviews and a questionnaire, namely the capability to get insights and opportunity for deeper additional data from the interviews [3], and the objectivity and potential for generalizable findings of the questionnaire [4], would help the process of identifying the most useful PM practices. Additionally, the triangulation of data would facilitate the validation of information [5].

Firstly, semi-structured interviews and qualitative data analysis were conducted in order to explore and identify the perceived most useful PM practices in different organizational contexts. Secondly, a survey questionnaire was administered, with the objective of getting views from more people and confirming or not the findings interviews.

4. The interviews study

4.1 Conducting and analysing the interview responses

For the first phase of the study, thirty semi-structured interviews were carried out in seven different organizations (industries, sizes, project types) as indicated in Table 3. Due to budget and time restrictions and personal privileged access, only personnel in Portuguese organizations were interviewed. The subjects had different roles in the organization - directors (17%), portfolio and programme managers (23%), project managers (53%) and team members (7%).

Table 3. Interviewed organization characterisation

Organization	Industry	Size	Number of Interviews
Organization 1	Research Centre	Small	5
Organization 2	Information Technology	Medium	3
Organization 3	Engineering and Construction	Large	4
Organization 4	Engineering and Construction	Medium	5
Organization 5	Telecommunications	Large	5
Organization 6	Information Technology	Small	4
Organization 7	Business Services	Small	4

The interviews were conducted between July and September 2012. Each interview lasted between one and three hours, the average was one hour and half. The interviews were conducted in-person at the interviewee's organization headquarters, except one that was conducted by video conference and five others by Skype call, because the interviewees spent most of their time at clients' sites.

The interview protocol related to the research question consisted of the following requests to interviewees: 1) Outline your experience in PM to date; 2) Characterize your organization in terms of business strategy and type of projects; 3) Tell stories of your organization initiatives to improve PM; 3) Identify the most useful PM practices that you use or have used; 4) Where appropriate, supplementary questions were used to prompt more detailed responses to the above questions. Although all participants had received by email a document giving an introduction to the study, each interview started with an introduction about the researcher's personal background, the research objectives, and the definition of some terms used in the study (e.g. PM practices, project management performance). Interview data was analyzed through thematic analysis [1] and application of Nvivo software.

4.2 Most useful PM practices interview results

Table 4 presents, in descending order, the PM practices most frequently identified by the interviewees as the most useful, with illustrative interviewee responses associated.

All the PM practices listed in Table 4 were stated by at least three or more interviewees (10% of the total interviewees). Other PM practices identified less often were: client acceptance form; customer satisfaction surveys; risk re-assessment; qualitative risk analysis; quantitative risk analysis; project issue log; work authorization; PM software to monitoring schedule; quality inspection; critical path method analysis; database of historical data; design of experiments; PM software to task scheduling; requirements traceability matrix; project web site.

The Nvivo software provides a facility for showing each items coded (PM practices) in terms of relative frequency of mentions by interviewees. The Nvivo 'map' (Fig. 1) presents the most useful PM practices identified as those more frequently suggested by interviewees. This rectangle presentation is automatically produced by Nvivo, which means for example the PM practice 'baseline plan' presented at the top left of the rectangle is the most mentioned and in the bottom right the least mentioned. In some rectangles of Nvivo 'map' the full text is not displayed - unfortunately, Nvivo 'map' facility does not allow users to format the text inside each rectangle.

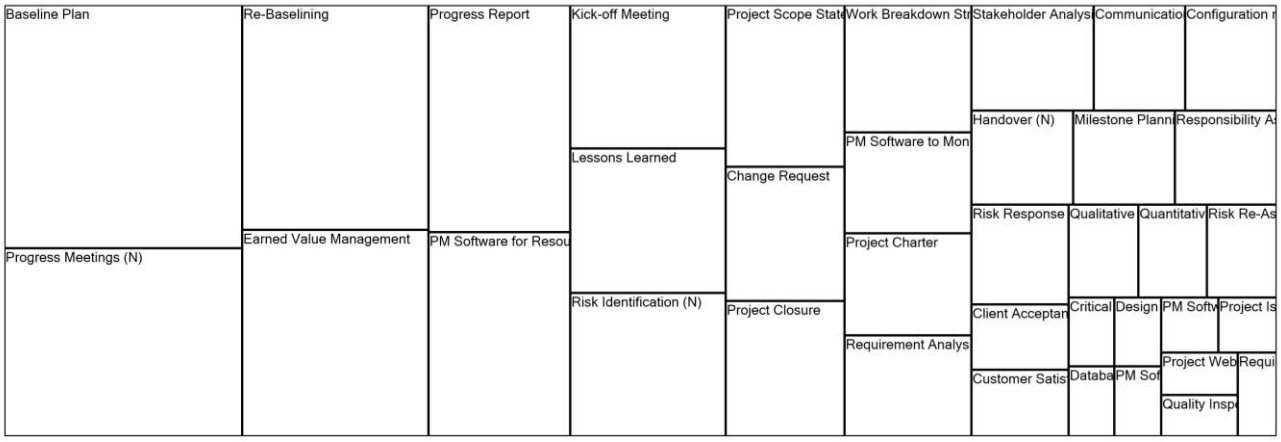

Fig. 1. Most useful PM practices compared by number of items coded

Table 4. Interviewee responses to the most useful PM practices

Most useful PM practices	**Some interviewee responses**
Baseline plan	"Project baselines for the control of scope, time, cost and quality." – (interviewee 1) "Detailed project plan. We make a little invest in planning, it is a cultural issue." – (interviewee 28)
Progress meetings	"Periodic progress meetings with the client and with the team, in order to communicate the difficulties and make decisions about the work in progress." – (interviewee 14) "Weekly progress meetings with the key project stakeholders in the organization." – (interviewee 19)
Re-baselining	"Continuous planning. Many times organizations make the big effort for the initial planning, but after don't make re-planning." – (interviewee 11) "Keeping the plan updated. Making an initial plan and then do not update it, doesn't serve for anything." – (interviewee 14)
Earned value management	"Earned Value Management is fundamental for my role. I can have the information of the project state with objective measures, without having to get involved in the project." – (interviewee 6)

PM software for resources scheduling	"Software for the management of human resources allocation, namely the % allocation of resources in different projects." – (interviewee 1) "Managing through software the allocation of shared resources." – (interviewee 23)
Progress report	"Progress reports, which includes the status report of each team member." – (interviewee 24)
Kick-off meeting	"Kick-off meeting for the analysis of the project's vicissitudes" – (interviewee 12) "Kick-off meeting with the team" – (interviewee 13)
Lessons Learned	"Registration of lessons learned throughout the project life cycle, not just at technological level, which is what has been happening, but more at a strategic level…" – (interviewee 23)
Risk identification	"Risk management. The project manager is 'bipolar', on one hand, he has to motivate the team, showing that they are capable of achieving the project's objectives, and on the other hand, he has to think and analyse everything that might run less well in the project. What are the project's risks?" – (interviewee 7)
PM software to monitoring cost	"Filling the timesheets." – (interviewee 22)
Project scope statement	"The detailed definition of the project scope. There would be always, or almost always, grey areas, but if at least we known them and we can anticipate them. This will solve many future problems." – (interviewee 10)
Work breakdown structure	"Scope definition using the Work breakdown structure." – (interviewee 29)
Project closure documentation	"Close reporting with variance analysis." – (interviewee 25)
Change request	"Change requests." – (interviewee 30)
Project charter	"Project charter. A document to formalize the project start." – (interviewee 26)
Stakeholder analysis	"Identification of the expectations of each involved in the project, named as stakeholders. Not only the customer, suppliers, the boss or the boss's boss…, but all those who, voluntarily or involuntarily, have or might have an influence during the project." – (interviewee 10)
Milestone planning	"Planning the major project milestones." – (interviewee 12)
Requirement analysis	"Clarification of the detailed requirements with the project stakeholders…" – (interviewee 14) "A template for gathering project requirements." – (interviewee 25)
Handover from the proposal team to the project team	"The 'transfer' of the proposal accepted by the customer to the project execution team, i.e., the transition of responsibility from the commercial manager to the project manager." – (interviewee 9)
Communication plan	"The development of the communication management plan." – (interviewee 11)
Responsibility assignment matrix	"RACI Matrix." – (interviewee 30)
Risk response plan	"Risk management, which involves both risk identification and planning responses. This practice must grow with the development of PM maturity level." – (interviewee 19)
Configuration review	"Documentation management, particularly for the control of documents changes and versions." – (interviewee 16)

5. The survey questionnaire study

5.1 Questionnaire data collection

For the second phase of the study, a worldwide on-line survey questionnaire was conducted. The questionnaire was divided into four parts. Parts A and B were used to answer different research questions of the study. Part C was a series of questions designed to investigate which are the most useful PM practices. As noted earlier, PM practices in this study are regarded as those tools and techniques that practitioners use to "do the job" to "execute a PM process". The part C questions concern the level of benefit that respondents consider they obtain using each PM practice on project management performance. Part D of the questionnaire gathered information about respondents, their experience and work context (e.g. industry, size, types of project, geographic location, role, PM experience, education level, gender and age).

Respondents were asked to answer only if they use or have used the PM practices. If not, respondents were asked to just tick the box 'not used'. In this way the researcher information was gathered from only respondents that have experience of each PM practice.

Each PM practice was rated on a 5-point Likert scale from 'very high' to 'very low'. The researcher had considered the use of a scale 1 to 4, in order to not give the respondent opportunity to choose the middle number in scale (3) and not take a position. However, since most people would expect one level at least separating points (2) - "low" and (3) - "high" of such a scale, the researcher adopted the 5-point Likert scale and decided to identify as the most useful PM practices those that rated on average at least 4.

The list of tools and techniques surveyed is the result from the interview analysis and complemented with the subset of 55 tools from 70 with the highest 'intrinsic value' (present extent of use + potential contribution to project performance if more or better used) from Besner and Hobbs [1], which almost half of the 55 tools and techniques (47%) were not identified by the interviewees. Although, only two tools and techniques: Gantt charts and activity list, in the top twenty of the highest 'intrinsic value', were not mentioned during the interviews. A total of 68 tools and techniques were surveyed. The tools were sorted to approximately follow the project life cycle, and in order to help respondents make clear distinctions, tools with similar names or related meanings were placed next to each other in the list.

Only one of the tools from the 55 tools with the highest 'intrinsic value' in Besner and Hobbs 2004 study [29], was not included - PM software for multiproject scheduling/levelling, because this research study is focused on tools to manage a single project.

The interview analysis only identified seven PM practices beyond the listed PM practices from Besner and Hobbs [1]:

- Progress meetings (the second most mentioned PM practice);
- Risk-reassessment;
- Project closure documentation;
- Handover (the proposal team to the project team);
- Requirements traceability matrix;
- Project management issue log;
- Design of experiments.

The researcher had also included in the questionnaire 5 of the 15 tools and techniques "discredited" by Besner and Hobbs [29]. This selection included those which had been "discredited" due to their limited extent of use, but which had been identified with potential contribution to project performance. As such they may be useful PM practices, which is what this study wants to find. Additionally, from the researcher professional experience, these are tools that bring high benefits to PM performance. They are:

- PM software for simulation;
- Critical chain method and analysis;
- Parametric estimating.

The other 2 "discredited" tools: Monte Carlo analysis and probabilistic duration estimate (PERT) analysis included in the questionnaire, although their limited extent of use and identified with limited potential contribution to project performance, the researcher professional experience and literature analysed pointed to the importance of these PM practices in a particular area of PM which is risk management [2]-[3]. The researcher understood that these tools are not extensively used, maybe because the knowledge required is high, thus inhibiting its use. However, this does not mean that they could not be useful PM practices.

Taking into account the responses obtained during the interviews, two tools - risk management documents and ranking of risk, from the Besner and Hobbs' study were rephrased for a better understanding from participants. They were rephrased to risk identification (one of the most identified PM practices by interviewees), qualitative risk analysis and quantitative risk analysis. With these three PM practices we get a better understanding of what risk management documents mean, and from the qualitative and quantitative risk analysis some risk ranking can be derived.

This research study has followed the distinction made by Besner and Hobbs [1] on the different functionalities of PM software, because, as Besner and Hobbs [1] has shown, the use of the different functionalities varies enormously. It is, therefore, inappropriate to consider PM software as a single tool with homogenous use. The decision to implement or support the use of PM software should take an approach that discriminates these varied uses.

Finally, two other PM practices: quality plan and close contracts were included in the questionnaire attending to the researcher's professional experience and the literature review [4],[5],[6], which the researcher want to understand from the practitioners' perspective if they are or not useful PM practices.

The questionnaire did not include a description of each PM practice, as the researcher just have interest in answers from people that use or have used the practice, therefore they should know their meaning. Also, adding even a brief description would have increased the length of the questionnaire.

5.2 Questionnaire population and sample

In academic research, any sample should be representative of the population and the sample size should take into account statistical significance and the anticipated response rate [7]. However, this research study used a non-probabilistic technique for sampling, the 'snowballing' technique. Therefore, there was no possibility of a predetermination of size of sample [8]. It was intended to cover PM practitioners over the world and the 'snowballing' sampling technique seems to be a suitable technique to pursue this objective.

In order to use the 'snowballing' technique it is necessary to have an initial list of contacts. The researcher gathered about 3.000 email contacts and used to advertise the questionnaire to the PM professional community. The contacts were from over one hundred different countries. Potential respondents were individually invited to complete the questionnaire sent out by email. Additionally, the researcher asked PM associations to advertise the survey to their members and invite them to consider taking part. From the 300 emails sent to different PM associations, about 10% supported this survey through advertisement on websites, newsletters, mailing to members and LinkedIn groups. Moreover, the survey was also accepted by the research program of PMI, which then had the possibility to post the survey directly on the website pmi.org. It was a lengthy questionnaire, which took around 15 to 20 minutes to complete. The questionnaire was available on-line between January and April 2013.

5.3 The dataset

Completed questionnaires were received from 793 practitioners worldwide, covering 75 different countries. The primary role of respondents was:

- Portfolio and programme manager: 19.9%
- Project manager: 42.9%
- Team member: 7.1%
- Functional manager: 6.3%
- Director: 16.2%
- Other: 7.6%

The countries with the highest participation were: Portugal (41%), United States (9%), United Kingdom (6%), Australia, Brazil and Netherlands (4%/ each), Canada, Italy, Spain and India (2%/ each). Participation is concentrated in these ten countries with 76% of the responses and the other sixty five countries with 24% of participation. The respondents were mostly between 30 and 50 years old (71.6%). Almost 50% of the respondents had more than 10 years of experience as a project manager and 15% had more than 10 years of experience as a portfolio or programme manager. They appear well qualified to provide valuable information. A vast majority had at least a postgraduate degree (83%), 33% had a postgraduate degree, 44% had a master degree and 6% a doctorate degree.

5.4 Most useful PM practices questionnaire results

Only 46% of the 793 respondents fully replied to this question, indicating that many respondents did not use or had not used some of the tools and techniques surveyed. The least used was the 'Monte-Carlo Analysis' and the 'PM software for simulation' with just 363 and 384 participants, respectively, indicating a level of benefit obtained on PM performance.

The following three Tables present the obtained rank in decreasing order of the most useful PM practices. Table 5 shows the top 20th most useful PM practices, Table 6 presents the most useful PM practices in the middle list, and Table 7 shows the bottom 20th most useful PM practices. Its examination reveals a variation in the perceived level of benefit that PM professionals obtain with the use of the specific tools and techniques on PM performance. For all tools and techniques the mean values range between 4.33 and 3.01. The median (the value above and below which half of the cases considered fall) is 4 for most of the tools and techniques (84%), as also the mode (the most frequent answer) is for 86% of the tools and techniques, which evidences the positive direction of respondents' answers. The standard deviations show low values (between 0.773 and 1.269) which indicate a low variability of answers.

The interpretation of these tables is straightforward. The tool perceived as the most useful is the 'progress report', while the one perceived as the least useful is 'Monte-Carlo analysis'. Curiously, exactly these two tools were identified by Besner and Hobbs [1] as the tools most and least used. This might indicate an expectable relation between the most used and the most useful tools and techniques.

As noted earlier, this study surveyed seven functionalities often served by PM software, Table 7 and 8 shows shaded in grey, that the seven functionalities of PM software surveyed vary greatly in their perceived level of benefit to PM performance. The 'PM software for task scheduling' and 'PM software to monitor schedule' are identified as the twenty-third and twenty-fourth most useful tools and techniques, respectively, while 'PM software for simulation' and 'PM software for resources leveling', are near the very bottom of the list. The other three functionalities - 'PM software to monitor cost', 'PM software for resources scheduling' and 'PM software for cost estimating', are in the middle of the list. Overall, the usefulness of PM software functionalities decreases for more complex usages.

Table 5. Statistical results of the 20th most useful PM practices

PM Practices	N		Mean	Median	Mode	Std. Dev.
	Valid	Missing				
1. Progress report	771	22	4.33	4.00	5	.773
2. Requirements analysis	752	41	4.33	5.00	5	.870
3. Progress meetings	772	21	4.32	4.00	5	.802
4. Risk identification	753	40	4.30	5.00	5	.895
5. Project scope statement	750	43	4.24	4.00	5	.850
6. Kick-off meeting	768	25	4.21	4.00	5	.853
7. Milestone planning	752	41	4.20	4.00	4	.832
8. Work breakdown structure	753	40	4.18	4.00	5	.914
9. Change request	753	40	4.17	4.00	5	.887
10. Project issue log	713	80	4.11	4.00	4	.886
11. Gantt chart	759	34	4.11	4.00	5	.957
12. Activity list	743	50	4.10	4.00	4	.875
13. Client acceptance form	705	88	4.10	4.00	5	.995
14. Risk response plan/Contingent plans	730	63	4.05	4.00	5	1.019
15. Project statement of work	726	67	4.04	4.00	4	.941
16. Communication plan	741	52	4.03	4.00	4	.940
17. Responsibility assignment matrix	715	78	4.00	4.00	4	.947
18. Baseline plan	730	63	3.99	4.00	4	.976
19. Qualitative risk analysis	719	74	3.98	4.00	4	.962
20. Project charter	704	89	3.97	4.00	5	1.007

Table 6. Statistical results of the most useful PM practices in the middle list

PM Practices	N		Mean	Median	Mode	Std. Dev.
	Valid	Missing				
21. Project closure documentation	745	48	3.93	4.00	4	.992
22. PM Software for task scheduling	716	77	3.91	4.00	4	1.034
23. PM software to monitor schedule	693	100	3.91	4.00	4a	1.046
24. Handover (the proposal team to the project team)	666	127	3.90	4.00	4	.985
25. Close contracts	664	129	3.88	4.00	4	1.013
26. Customer satisfaction surveys	705	88	3.87	4.00	4a	1.080
27. Stakeholder analysis	722	71	3.85	4.00	4	1.045
28. Lessons learned	739	54	3.85	4.00	4a	1.100
29. Product breakdown structure	649	144	3.84	4.00	4	1.016
30. Critical path method analysis	694	99	3.80	4.00	4	1.094
31. Re-baselining	688	105	3.79	4.00	4	1.008
32. Project communication room (war room)	616	177	3.78	4.00	4	1.047
33. Bottom-up estimating	676	117	3.76	4.00	4	.987
34. Requirements traceability matrix	616	177	3.76	4.00	4	1.046
35. Quantitative risk analysis	675	118	3.75	4.00	4	1.076
36. Feasibility study	653	140	3.72	4.00	4	1.029
37. PM software to monitor cost	627	166	3.71	4.00	4	1.142
38. PM software for resources scheduling	678	115	3.71	4.00	4	1.105
39. Bid documents	637	156	3.70	4.00	4	.978
40. Cost/benefit analysis	697	96	3.70	4.00	4	1.053
41. Risk re-assessment	675	118	3.69	4.00	4	1.087
42. Quality inspection	695	98	3.65	4.00	4	1.010
43. Financial measurement tools (eg. ROI , NPV)	675	118	3.64	4.00	4	1.071
44. Top-down estimating	672	121	3.64	4.00	4	1.037
45. Team building event	699	94	3.62	4.00	4	1.052
46. Work authorisation	637	156	3.61	4.00	4	.970
47. Self-directed work teams	626	167	3.60	4.00	4	1.021
48. Quality plan	716	77	3.56	4.00	4	1.042

a- Multiple modes exist. The smallest value is shown.

Table 7. Statistical results of the bottom 20th most useful PM practices

PM Practices	N		Mean	Median	Mode	Std. Dev.
	Valid	Missing				
49. Bid/ seller evaluation	589	204	3.54	4.00	4	1.047
50. Team member performance appraisal	660	133	3.53	4.00	4	1.034
51. Earned value management	605	188	3.51	4.00	4	1.163
52. PM software for cost estimating	625	168	3.50	4.00	4	1.163
53. Database of risks	566	227	3.49	4.00	4	1.109
54. Network diagram	609	184	3.46	4.00	4	1.162
55. Project Web site	636	157	3.44	3.00	3	1.097
56. Critical chain method and analysis	468	325	3.44	4.00	4	1.153
57. Database of contractual commitment data	525	268	3.43	4.00	4	1.081
58. Database for cost estimating	524	269	3.43	4.00	4	1.115
59. Database of lessons learned	660	133	3.42	3.00	3	1.183
60. Configuration review	593	200	3.39	3.00	3	1.035
61. Parametric estimating	508	285	3.38	3.00	3	1.062
62. PM software for resources levelling	623	170	3.38	3.00	3	1.195
63. Database of historical data	595	198	3.33	3.00	3	1.081
64. Probabilistic duration estimate (PERT)	533	260	3.30	3.00	4	1.201
65. Design of experiments	505	288	3.29	3.00	3	1.091
66. Bidders conferences	489	304	3.27	3.00	3	1.093
67. PM software for simulation	384	409	3.08	3.00	3	1.269
68. Monte-Carlo analysis	363	430	3.01	3.00	3	1.230

The top twenty of the list of the most useful tools and techniques (mean ≥ 4.0) is composed by very well-known and widely used tools. There are few surprises here. Fig. 2 shows that the practices acknowledged cover the overall PM life cycle from initiation to project closing, although particular relevance is given to tools and techniques from planning. The areas of knowledge - scope, time, risk, communication and integration, assume a high relevance amongst the most useful PM practices, each with at least three PM practices on the top of the list. For example, under the risk management practices were identified: 'risk identification'; 'risk response plan'; and 'qualitative risk analysis'. Curiously, none of the tools from the area of cost or quality, related usually to the project's objectives, are in the top of the list.

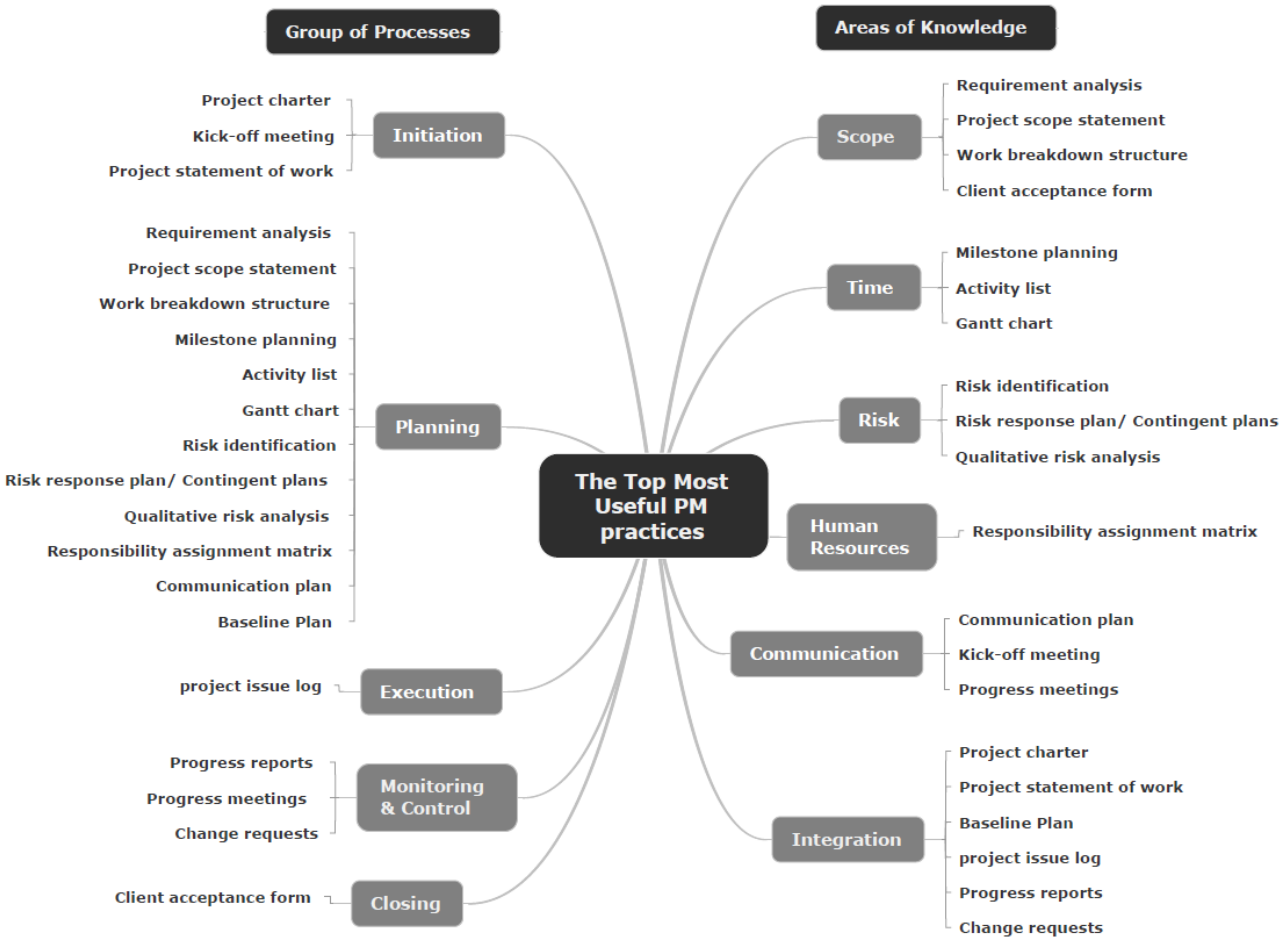

Fig. 2. The top twenty most useful PM practices by group of processes and areas of knowledge

The set of the top most useful PM practices identified from the survey (Table 5) is largely similar to the set identified from the interviewees (Table 4). However, on the survey results other PM practices got more significance as: project issue log; Gantt chart; client acceptance form; activity list; project statement of work; and qualitative risk analysis.

This research had hypothesized that the concept studied by Besner and Hobbs [1], 'intrinsic value' of a tool and technique corresponds to the concept investigated by this research of 'most useful' PM tools and techniques. The survey results showed that fifteen of the twenty most useful tools and techniques identified in the survey (Table 5) are the same identified by Besner and Hobbs [1] with the highest 'intrinsic value' (Table 2). Table 8 shows the differences between the positions from the Besner and Hobbs' list and the results of this study. For example, 'client acceptance form' is positioned in the thirteenth position and in Besner and Hobbs' study assumes a lower position (20^{th}).

Table 8.Comparisons between the 20th most useful PM practices with 20th 'highest intrinsic value' from Besner and Hobbs [1]

PM Practices	**Position in this study**	**Position in Besner & Hobbs' study**
Progress report	1st	2nd
Requirements analysis	2nd	4th
Progress meetings	3rd	Not included
Risk identification	4th	14th
Project scope statement	5th	3rd
Kick-off meeting	6th	5th
Milestone planning	7th	11th
Work breakdown structure	8th	10th
Change request	9th	8th
Project issue log	10th	Not included
Gantt chart	11st	6th
Activity list	12nd	15th
Client acceptance form	13rd	20th
Risk response plan/Contingent plans	14th	18th
Project statement of work	15th	12nd
Communication plan	16th	-
Responsibility assignment matrix	17th	-
Baseline plan	18th	17th
Qualitative risk analysis	19th	19th
Project charter	20th	-

Two of the tools and techniques, not included in Besner and Hobbs [1] study, but identified by the interview data analysis as most useful PM practices - 'progress meetings' and 'project issue log', were positioned in top positions, the third and tenth position, respectively. The tools and techniques 'communication plan', 'responsibility assignment matrix' and 'project charter', are in the middle of the list of Besner and Hobbs' study.

Several reasons may explain the presence of a tool on the bottom of the list. Individuals can use some tools without any organizational investment or support. For example, the use of a project charter or a Gantt chart does not require any specialized resources. However, the use of databases does require significant organizational resources and support, and these tools may not be used properly, or fully used, because of the lack of resources and support, for respondents to perceive their level of benefit. Most of the tools and techniques on the list have been in wide circulation for over 15 years with the exception of, for example, the critical chain method. The relatively recent arrival of such tools on the PM scene may, at least partially, explain their low usage levels (selection of 'not used') and the perceived level of benefit.

6. Conclusion

This paper contributes to professional community by setting priorities for improving PM performance. Organizations and practitioners can identify ways to develop and enhance their PM practices by examining the tools and techniques identified in this study as the most useful to increase PM performance.

Firstly, semi-structured interviews and qualitative data analysis were conducted in order to explore and identify the perceived most useful PM practices from different organizational contexts. Secondly, a survey questionnaire was administered, with the objective of getting views from more people and confirming or not the findings from interviews. A total of 68 tools and techniques were surveyed. Only 46% of the 793 respondents fully replied to the 68 tools and techniques, indicating a level of benefit obtained on PM performance. The results show a variation in the perceived level of benefit that PM professionals obtain with the use of the specific tools and techniques on PM performance. For all tools and techniques the mean values range between 4.33 and 3.01. The median is 4 for most of the tools and techniques (84%), as also the mode is for 86% of the tools and techniques, which evidences the positive direction of respondents' answers. The standard deviations show low values which indicate a low variability of answers. The tool perceived as the most useful is the 'progress report', while the one perceived as the least useful is 'Monte-Carlo analysis'. The set of the top most useful PM practices identified from the survey (Table 5) were largely similar to the set identified from the interviewees (Table 4). However, on the survey results other PM practices get also high significance as: project issue log; Gantt chart; client acceptance form; activity list; project statement of work; and qualitative risk analysis.

One important issue in PM is that is highly contingent on the organizational context, such as structure of business or industry sector, size, and its environment [41], [11]. As argued by Besner and Hobbs [18] "There is a widespread recognition of the variability of PM practice by project type and by application area and other contextual factors". The research is progressing, analyzing the quantitative data in order to find if the most useful PM practices are dependent on the organizational context (e.g. industry, size, project types and geographic location). The question deals with the identification of which practices differ in which contexts, and what future developments in PM practice do these results suggests.

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