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## Study on project management in Portugal within the scope of the Portuguese Project Management Observatory

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### Abstract

The Portuguese Project Management Observatory (PPMO), an initiative of the Portuguese Association of Project Management (APOGEP), is being developed by the University of Minho in partnership with other 17 Higher Education institutions. The main objectives of this research were to understand the tools and techniques most and least used by organizations, the use of agile methodologies, the maturity of each Project Management area, and success dimensions. The method selected for this study was a survey applied through an online questionnaire directed to Portuguese organizations. The results show that the most used Tools and Techniques are Kick-off Meeting, Progress Meetings, Project Work Description, Gantt Chart, and Activity List; and the least used are Monte Carlo Analysis, Decision Tree, Project Management Software for Simulation, Conferences for Bidding, and Parametric Estimation. Statistically significant differences were found between the use of various Tools and Techniques and factors such as gender, age, current position, education level, and activity sector. Agile methodologies are used in a large part of the respondents' organizations, however, no correlation was identified between the use of agile methodologies and the accomplishment of scope, time and cost of projects. The process identified as having the highest maturity is Definition of Activities in the Project Schedule Management area, followed by Project Execution in the Project Integration Management area, and the Schedule Development in the Project Schedule Management area. Customer Satisfaction is the KPI most used.

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## 1. Introduction

The Portuguese Project Management Observatory (PPMO), an initiative of the Portuguese Association of Project Management (APOGEP), is being developed by the University of Minho in partnership with other 17 Higher Education institutions. It will include the development of a digital platform to gather and disseminate knowledge regarding Project Management (PM) in Portugal. The main goal of this project is to increase the visibility of the PM community and promote and enhance research in this area [1]. The PPMO is committed to: conduct an annual report on the study of the profession in Portugal; stimulate the creation of knowledge in the area; gather the generated knowledge, particularly in Academia and Industry; support the Association in defining and promoting dissemination actions [1].

The main objectives of this research were the following: to study which tools and techniques are used by organizations; to understand if organizations have implemented agile methodologies; to understand the maturity of each PM area; and, finally, to measure the success of their projects and which Key Performance Indicators (KPIs) are used to measure success. This study was conducted using an online questionnaire [2] developed by the researchers, followed by collection and analysis of the obtained responses. The central goal of this project is to investigate the status of PM in Portugal and to better understand the Portuguese reality in this area. The method chosen to conduct this study was a survey applied through an online questionnaire directed at Portuguese organizations.

The work was developed considering the following research Questions (Q1 to Q8) related to the above-mentioned themes:

**Q1:** What are the most and least used Project Management tools and techniques by Portuguese organizations?

**Q2:** Can factors such as age, gender, years of experience, position or educational level influence the selection of tools and techniques in Portuguese organizations?

**Q3:** Can the selection of tools and techniques of Project Management be influenced by the sector of activity in which Portuguese organizations operate?

**Q4:** Do organizations use agile methodologies in their operations? If so, which one do they use the most?

**Q5:** Does the use of agile methodologies influence whether projects finish within scope, time and cost?

**Q6:** What level of maturity can be observed in Portuguese organizations regarding Project Management tools and techniques?

**Q7:** Does a company's level of the maturity in PM be influenced by its sector of activity?

**Q8:** Which KPIs do organizations value the most and the least?

## 2. Research Methodology

### 2.1. Questionnaire Survey Method

This research project was based on a quantitative methodology, using a survey strategy for gathering data through an online questionnaire. Each respondent is asked to respond to an identical set of questions in a predetermined order as part of the data survey method used in the questionnaire. The questionnaire offers an effective technique to gather responses from a large sample, because each respondent is required to answer the same set of questions. The questionnaire should gather the data necessary to respond to the research questions and thus achieve the proposed goals [3].

Given the current pandemic situation, the online questionnaire was considered the easiest and simplest way to reach people and organizations. Lime Survey, the platform used to conduct the questionnaire, was considered the right solution to create an online survey. The questionnaire was created from scratch by the researchers and was based on several previously studies [4–7]. After data collection, several statistical analyses were performed to analyze and

present the data. The statistical software SPSS - Statistical Package for the Social Sciences was used for data analysis [8,9]. In particular, the Kruskal-Wallis and Mann-Whitney-Wilcoxon non-parametric hypothesis tests were computed, and multiple comparisons tests were performed after rejection of the null hypothesis on identical behavior of the different populations under study. The aim was to determine which pairs of the populations tended to differ. The results from the statistical tests were evaluated using the 5% significance level as the threshold for distinguishing between “not statistically significant” and the opposite. It is worth stressing that the results of some of these tests will not be reported here due to the lack of space.

## 2.2. Questionnaire Design

The questionnaire was divided into 6 sections: Respondent Characterization; Organization Characterization; Project Management Tools and Techniques; Maturity Model; KPIs; Opinions and Suggestions. Respondent characterization was based on multiple studies, such as [6], where it is mentioned that the developed questionnaire collects the position, education, and experience level of the respondent; [4] collects age, gender, current position, and seniority in PM; and [5] mentions area of training, level of education and current position. Regarding organization characterization, the first three questions concerned geographical area, district, and city. The study done by Tereso et al. [4] refers variables such as sector of activity, organizational size, and strategic positioning, which were also considered in this research.

The PM Tools and Techniques section was divided according to project life cycle instead of being divided by the ten knowledge areas of the PMBOK [10], as Tereso et al. [4] did in their research. PM Tools and Techniques were grouped according to the five process groups: Initiation, Planning, Execution, Monitoring and Control, and Closure. In each process group, the respective Tools and Techniques were provided to answer the following research question: “How often do you use the following project management tools and techniques?”. The Tools and Techniques were listed in alphabetical order, with a Likert Scale of frequency of use from 1 to 5: 1 – Never; 2 – Rarely; 3 – Occasionally; 4 – Frequently; 5 – Very Frequently.

The selection of Tools and Techniques was based on a cross-check of data from several studies [4,6,7,11–14]. All these studies were based on the studies of Besner and Hobbs [6,11] which are major contributions to the literature on PM Tools and Techniques. Another important factor is the fact that studies [6,11], were based on one of the most influential standards internationally – the PMBOK [10].

The maturity model used in the questionnaire was based on the Project Management Maturity Model [15]. This model is based on the ten knowledge areas of the PMBOK. Given the maturity models studied, this model was more in line with the research needs, so the researchers chose to adapt it to the questionnaire. Maturity was assessed through the ten knowledge areas of the PMBOK: Project Integration Management; Project Scope Management; Project Schedule Management; Project Cost Management; Project Quality Management; Project Resource Management; Project Communication Management; Project Risk Management; Project Procurement Management; Project Stakeholder Management [10].

To understand the success of projects in Portuguese organizations through the Maturity Model and the Agile Methodologies, it was necessary to create a group to understand whether there were correlations or different behaviors between these variables. The respondents were asked about the number of projects in which they had participated, the average duration of the projects in which they were involved, and which projects ended within scope, time, and cost.

## 3. Literature Review

### 3.1. Project Management Practices

Delivery and support of PM processes within the company is accomplished using PM tools and techniques. The Work Breakdown Structure and Earned Value Management are two examples of them. The correct application of PM tools and techniques should facilitate the implementation of its guiding principles [7].

In this research, the researchers selected PM tools and techniques based on other studies [4,6,7,11–14] which in turn are also present in one of the best-known standards in the world of PM: the PMBOK [10]. This selection aimed to approach the known PM tools and techniques and to make a comparison with previous studies. The number of tools

and techniques selected for the study were 78. This list is not presented here due to the lack of space, but in the results and discussion section the most and least used are presented.

To facilitate data survey and analysis and better understanding by the respondents, the PM tools and techniques were categorized through the Process Groups, like study of Tereso et al. [4], instead of the knowledge areas used in other studies [6,7,11,16].

### 3.2. Traditional and Agile Project Management

Traditional project management tools and techniques are organized in groups of sequential processes, because this approach is based on a rigorous perspective of society, human nature and perceptions, human knowledge and actions, as if humans were perfectly predictable beings. This strategy has been used for many years, is plan-oriented with limited room for change, and has a top-down leadership style, i.e., it is built on hierarchy, command, and control [18]. Traditional projects have clear definitions, are well documented, and have characteristics, functions, and needs that are well understood from the very beginning. The typical project manager manages their projects in accordance with scope, time and cost while reducing risk and maintaining time and financial restrictions. Due to their well-defined requirements and documentation, traditional projects may readily support dispersed work teams and younger participants [19]. The Waterfall model is the most frequently used in standard PM approaches. Since the Waterfall model separates the development process into stages and is an example of a plan-driven process, it is critically important to first plan and organize all process actions before beginning the product development [20].

Agile Project Management was developed as a new methodology to accommodate the set of changes in response to the dynamic environment, changing requirements, and technology in recent decades. The ability to quickly develop new, innovative, and high-quality goods and services is crucial to business agility [21]. Agile methodologies are appealing and practical options for businesses. Especially with regard to software development, it enables organizations to accomplish quality, project budget management, alignment with the organizational business plan, and deliver frequent and consistent value [22]. It is important to keep in mind that Agile Project Management has high potential and may be used for other sorts of projects, even though it started with a particular focus on software development [18]. Iterative planning and development cycles occur frequently and quickly in the agile methodology, which makes it possible to continually assess intermediate findings and adapt if users and stakeholders so choose. This allows the project team, which includes the stakeholders, to continuously enhance the final product [18]. Scrum, Extreme Programming (XP), Kanban, Feature-Driven Development (FDD), and Crystal are some of the most popular agile methodologies. Scrum is currently considered the most extensively used agile methodology [23]. Large-scale agile approaches have been developed to satisfy this demand when multiple teams are using Scrum and working concurrently on the same project [22]. Therefore, some examples of such approaches include the Scaled Agile Framework (SAFe), Large-Scale Scrum (LeSS), Disciplined Agile Delivery (DaD), and Scrum of Scrums (SoS).

### 3.3. Maturity Models and Key Performance Indicators

A Project Management Maturity (PMM) model assesses an organization's overall capacity in terms of project management techniques, such as managing projects, programs, or portfolios [24]. A maturity model is a concept that describes qualitative traits and certain capabilities that are used to categorize an object of competence in one of many predetermined domains [25].

Various project management maturity models are used today, with most of them being influenced by the Capabilities Maturity Model Integration (CMMI), which was created in the early 1990s and was first designed to assess the capability of software development projects. According to research, companies with higher levels of PMM are predicted to succeed in terms of project effectiveness and efficiency, giving them a competitive edge in the market [26].

Organizations aiming to increase the efficiency of their project management to produce long-term successful projects might specify improvement objectives using a maturity model. Some researches even indicate that there is no proof of the consequences of employing maturity models [25].

To evaluate PM maturity, more than 30 different models can be employed. The following 4 models received additional attention: Project Management Maturity Model by PM Solution; Project Management Maturity Model by

Kerzner; Organizational Project Management Maturity Model by PMI; Capability Maturity Model Integration (CMMI) by the CMMI Institute [27].

The success of a project depends on efficient performance measurement. A key performance indicator measures the effectiveness of a task that is essential to the success of an organization or a project. Performance of projects and organizations across the sector can be assessed using KPIs. The following are the primary performance indicators that English Small and Medium-sized Enterprises (SMEs) use: productivity, quality performance, profitability, innovation, employee development, customer satisfaction, and delivery to customers [28]. Successful initiatives require knowledgeable and talented employees. The Standish Group's CHAOS study has highlighted that competent people are one of the critical success criteria in projects. To ensure professional competence, professionals must adhere to five important principles: 1) determining the necessary abilities and backup skills; 2) offering a quality program of ongoing training to help people develop their talents; 3) hiring from both within and outside the company to provide a variety of experience; 4) offering rewards to encourage people; 5) ensuring that everyone is paying attention to the project. A project may succeed even in the most challenging situations when there is teamwork and qualified resources [29].

## 4. Results and Discussion

### 4.1. The Dataset

The questionnaire's target population is all people who work with projects and in Project Management: e.g., the members of APOGEP. The questionnaire was initially disseminated in the social networks of PPMO and APOGEP and shared with APOGEP members. Subsequently, to achieve a greater number of responses, an e-mail was sent to companies across multiple sectors of activity. 133 professionals submitted completed questionnaires.

For an in-depth characterization of the population of Project Management, in the initial stage it is critically important to characterize the sample regarding age, gender, level of education, basic training, and years of experience in projects. These variables are of paramount importance for this research.

Related to gender, 50 (37.59%) respondents are female and 80 (60.5%) are male. 3 (2.26%) of the respondents did not answer. The comparison between gender by age was done and the results are presented in Table 1. It should be noted that both female and male genders are prevalent in age group between 40 and 59 years.

Table 1. Respondents by gender and age.

Gender	Age groups			Total
	23 - 39 years	40 - 59 years	> 59 years	
Male	28 (21.05%)	47 (35.33%)	5 (3.75%)	80 (60.15%)
Female	22 (16.54%)	28 (21.05%)	0 (0.00%)	50 (37.59%)
No answer	2 (1.50%)	1 (0.75%)	0 (0.00%)	3 (2.26%)
<b>Total</b>	52 (42.11%)	76 (54.14%)	5 (3.76%)	133 (100.00%)

Regarding the level of education and position, 1 respondent with secondary education holds the position of Director. And with Post-Secondary Education, there is 1 respondent who is Program Manager. There are 2 Project Managers and 1 Program Manager holding a bachelor's degree. With a Degree, there is 1 respondent with the Developer and PMO role, 3 with the Director role, Portfolio Manager, Member of a Project and Project Management Team, 5 respondents as Program Managers, 18 as Project Managers and finally 6 respondents are Functional Managers. The Masters level of Education is the level that stands out the most, having 24 Project Managers, 8 Directors, 5 Program Managers, 4 PMO and 4 Member of a Project Management Team and, finally, 1 Portfolio Manager, 1 Scrum Master, 1 Developer and 1 Functional Manager. At the last level of education, PhD, there are 2 Directors, 3 Program and Portfolio Managers, 2 PMO, 1 Product Owner and 1 Member of a Project Management Team.

Regarding Years of Experience in Projects, 32 respondents have 0-5 years of experience in projects; 32 have 6-10 years; 47 have 11-20; and 22 have more than 20 years of experience in projects. The mean of Years of Experience in Projects was 12.72 years; the mode was 20 years; the standard deviation was 8.35 years; the minimum number of experience in projects was 0 years, and the maximum number was 34 years of experience.

#### 4.2. Answers to the research questions

To respond to **Q1**, initially it was necessary to perform a descriptive analysis of each tool by frequency of use (Never, Rarely, Occasionally, Often, Very Often) and then calculate the overall rating for each tool. The ten tools and techniques most used by the Portuguese organizations are the following: Kick-off Meeting; Progress Meetings; Project Work Breakdown; Gantt Chart; Activity List; Project Close-Out Documentation; Requirements Analysis; Progress Report; Project Charter; Milestone Planning (see Fig. 1). The ten tools and techniques least used by the Portuguese Organizations are as follows: Monte Carlo Analysis; Decision Tree; PM Software for Simulation; Bidding Conferences; Parametric Estimation; Learning Curve; Critical Chain Method and Analysis; Value Added Management; Trend Graph; and Probabilistic Estimation of Duration/PERT.

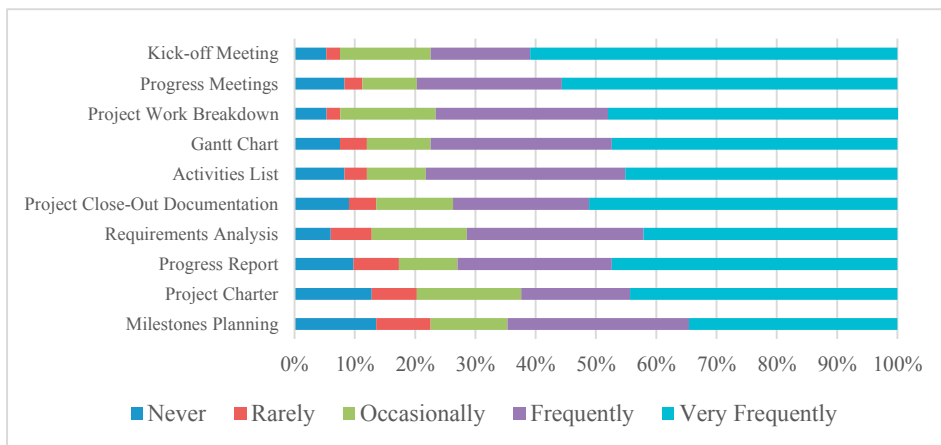


Fig. 1. Most used Project Management Tools and Techniques.

To answer to **Q2**, the Kruskal-Wallis test was computed to assess whether the behavior of each of the 78 Project Management Tools and Techniques is identical across the following variables: Gender; Age; Years of Experience; Current Position/Function; Educational Level. The Kruskal-Wallis test was performed individually for each practice in each variable. Regarding gender, it was identified 1 practice where the behavior is different (Quality Function Implementation); regarding age, 7 practices were identified (e.g. Cost Life Cycle and Parametric Estimating); regarding years of experience, 7 practices were also identified (e.g. Bottom-up Estimation and Requirements Traceability Matrix); regarding position, 28 practices were identified (e.g. Kick-off Meeting and Project Charter), making it the variable with most differences; and 12 practices were identified regarding educational level (e.g. Project Charter and Handover from the Proposal Team to the Project Team).

**Q3** was concerned with the relationship between PM tools and techniques and activity sectors, i.e., whether the selection of tools and techniques in organizations is different depending on the sector of activity. It was also found that the behavior regarding the following practices is different across activity sectors: Database for Cost Estimation; Authorization of Work; Evaluation of Suppliers' Proposals; Performance Evaluation of Team Members; Customer Satisfaction Questionnaires.

Regarding **Q4**, it was found that agile methodologies are used in most respondents' organizations, and the most widely used methodology by organizations is Scrum, followed by the Kanban methodology.

To investigate **Q5**, regarding similarity of behavior between respondents who use Agile Methodologies and those who do not and projects that end within Scope, Time and Cost, the Mann-Whitney-Wilcoxon test was applied for each of the variables. This test is applied to compare results between two independent populations to detect whether distributions are equal. In this case, it aimed to test whether the distributions are equal regarding projects that end within the Scope, Time and Cost in the populations that answered "Yes" or "No" to the use of Agile Methodologies. There was no difference between the population that use Agile Methodologies and the population that does not, considering the projects that finish within the initially planned Scope, Time and Cost.

Regarding **Q6**, in the Integration Management area, the process is "Monitoring and Control of Project Work" is the one that operates with highest maturity in Portuguese organizations; in the Scope Management area it is "Definition

of the Scope"; in the Schedule Management area, it is "Definition of Activities"; in the Cost Management area it is "Budget Determination"; in the Quality Management area it is "Quality Control"; in the Resource Management area it is "Resource Acquisition"; in the Communication Management it is "Communication Monitoring"; in the Risk Management area it is "Risk Identification"; in the Procurement Management area it is "Procurement Control and Supplier Management"; and finally, in the Stakeholder Management area it is "Stakeholder Identification".

All these processes are at level 3 of the Project Management Maturity Model.

Regarding Q7 about maturity level across activity sectors, a Kruskal-Wallis test was conducted to assess whether the behavior between each of the 49 Maturity Processes and the Activity Sector is identical. The p-values were all higher than 0.05, so the results showed no significant differences. It was established that the behavior between maturity processes and activity sector are identical across all activity sectors and all maturity processes.

The question "Which KPIs do you usually use in your organization?" helped to identify which key indicators are most used and valued by organizations, with each respondent being able to select more than one option. To answer to Q8 related to the KPIs with the highest frequency of use in Portuguese organizations, which are supposedly the ones that organizations value most, "Customer Satisfaction" was selected 88 times by respondents, followed by "Time" with 79 answers, and "Cost" with 73.

The KPIs least valued by organizations are "Employee Satisfaction Index", "Level of Employee Involvement", "Capacity Utilization Rate", all three with just six responses from respondents; and finally, "Waste Reduction Rate", which was selected four times.

## 5. Conclusions and Future Research

The ten most used tools and techniques by the Portuguese organizations are: Kick-off Meeting; Progress Meetings; Project Work Breakdown; Gantt Chart; Activity List; Project Closeout Documentation; Requirements Analysis; Progress Report; Project Opening Statement; Milestone Planning. The least used ten tools and techniques by Portuguese Organizations are: Monte Carlo Analysis; Decision Tree; PM Software for Simulation; Bidding Conferences; Parametric Estimation; Learning Curve; Critical Chain Method and Analysis; Value Added Management; Trend Graph; Probabilistic Estimation of Duration/PERT. In relation to PM tools and techniques and the variables gender, age, years of experience, position and educational level, it was identified in each of these variables, practices where there are statistically significant differences, which leads us to believe that the behavior among the PM tools and techniques varies with these factors. Regarding PM tools and techniques and sectors of activity, it was also found that the behavior in some practices is different across sectors of activity, leading us to believe that the practices are influenced by the sector of activity.

The agile methodologies are used in most of the respondents' organizations; however, no correlation was identified between the use of agile methodologies and the accomplishment of scope, time, and cost of projects.

Regarding the maturity model, in the following management areas: Integration; Scope; Schedule; Cost; Quality; Resource; Communication; Risk; Procurement; and Stakeholder, the processes with higher maturity in Portuguese organizations are, respectively: "Monitoring and Control of Project Work"; "Definition of the Scope"; "Definition of Activities"; "Budget Determination"; "Quality Control"; "Resource Acquisition"; "Communication Monitoring"; "Risk Identification"; "Procurement Control and Supplier Management"; and "Stakeholder Identification".

No statistically significant correlation was found between the accomplishment of scope, time and cost of the projects and the level and use of the maturity model. It was also concluded that the behavior between the maturity processes and the activity sector are identical across all activity sectors and all maturity processes in this research.

Finally, the KPIs most valued by organizations are Customer Satisfaction, Time and Cost. The KPIs least valued by organizations are Level of Employee Involvement; Capacity Utilization Rate; and Waste Reduction Rate.

This research will be conducted every year by the PPMO to find out how the Project Management evolves in Portugal (a longitudinal study). It would be interesting to extend the study to include tools and techniques for multiple projects, and tools and techniques for program management and portfolio management.

Regarding the methodologies used by the organizations, in a future questionnaire it would be interesting to address the hybrid approaches used in organizations, that simultaneous use agile and traditional methodologies.

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