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Project Management Maturity Models: Proposal of a Framework for Models Comparison

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Abstract

With the evolutions of projects, it is necessary that companies understand the importance of project management, since this idea allows them to plan and monitor a project properly, through a set of knowledge, techniques, and tools. However, the implementation of project management alone is not enough. It is necessary that there is a continuous improvement in project management and an increase in maturity that accompanies the changes and needs of companies. These improvements and increases in maturity level are possible with the application of maturity models in project management. When well used, they allow companies to understand where they fail and where they need to improve. And if the measures taken from the models are applied, companies benefit positively in the delivery of the intended results, on time and on budget. As well as, in standing out compared to other companies in the market. Therefore, this study proposed a framework to compare project management maturity models. It allows the consideration of a set of variables when choosing a model. The results show that the Prado PMMM is typically the most suitable model for evaluation.

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Keywords: Project management; Maturity in project management; Maturity models; Comparison of Project Management Maturity Models.

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1. Introduction

It is a fact that companies have several challenges about project management. Ensuring that they keep pace with change, that they are aligned with the strategy, and that they stick to the plan are some examples of these challenges.

Often, the deficiencies in project management practices that go with these challenges are only noticeable when performance reporting does not provide sufficient information. In this way, it becomes important that companies undergo a periodic assessment of their project management maturity, as this allows them to increase the probability of the institution performing its functions without errors and unforeseen events, minimizing waste, and keeping up with change and the company's strategy [1].

This assessment is possible using project management maturity (PMM) models that in fact allow the structuring of practices through a sequence of levels, from an initial and premature level to a level whose maturity allows it to stand out in the market. However, some organizations, when understanding the importance of the theme, become resistant when submitted to the evaluation of the degree of maturity in project management. This is because, recognizing gaps, admitting the fear factor, identifying issues of culture and even legal aspects, is something costly. Yet, by capturing these constraints, it is easy to find solutions to mitigate them. An example of this is the maturity assessment manager holding debriefing meetings with a smaller and less resistant group, to achieve good results at the beginning of the assessment [2].

In a study conducted by PM Solutions, it was possible to observe that, improving the maturity level of project management, results in significant performance benefits, especially in customer satisfaction. And therefore, when an organization reaches the desired level of maturity, it has a widespread project management culture [3].

However, to reach levels of excellence, it is necessary to spend a lot of time and effort [4]. According to Kerzner, it takes up to 7 years to reach the level of excellence. This means that by the time other companies realize the shortcomings in the management of their projects, the company that implemented the measures at the right time is already 7 years ahead [1].

In this sense and even knowing the difficulty of achieving success in the subject, the benefits of applying maturity models of project management in companies, are huge. And for that reason, this study aims to compare the PMM models based on a previously developed framework with some modifications. It should be noted that this framework was inspired mainly through the research provided by authors, Silva R., & Santos E. [5], and therefore it is important to emphasize that the veracity of some variables found in the framework of this author extends beyond the maturity models studied by him, verified the extent of its applicability. We use this adaptation for comparing several models, namely, Prado's PMMM, KPMMM, OPM3, PMMMSM and NPM3. This will allow us to understand how they work and which characteristics are best suited to the implementation of an evaluation in a business [4].

That said, this paper is divided into five chapters. The first chapter concerns the introduction, where the main relevant points are made known to the reader. It deals with the background and motivation, the objectives, and the structure of the document. In the second chapter, a contextualization of what are maturity models in project management is given, in which, in the same vein, the models mentioned above are described. The third chapter refers to the research methodology applied. Where is explained the process used to guide the investigation. The fourth chapter represents the research objective in question. So, it is possible to denote the comparison framework proposed, adapted from authors Silva R., & Santos E. [5], and its subsequent application. And finally, the last chapter, chapter five, represents the situation where some conclusive points are outlined, as well as limitations that should be considered for the future.

2. Project Management Maturity Models

Maturity models describe the level of development of an organization by assessing its current performance. This enables the structuring of tactics and strategies for continuous improvement [6]. More specifically, through a division of evolutionary progress into a sequence of levels or phases, which form a logical path from an initial state to a final level of maturity, allowing to derive and prioritize improvement and control measures in the progress of change [7].

The initial state or starting level of any maturity model, represents an organization with little capability of the domain under consideration. In contrast, the final level, which represents the highest stage, translates a conception of

full maturity. Advancing along the evolution path between these two extremes involves a continuous progression with respect to the capabilities or performance of the organization's processes [8].

Regardless of the discipline and application characteristics, models are used to assess and improve the development process, whether of product or service [9]. There are several maturity models with different factors and ways to achieve the goal [10]. However, they all have a set of common components, namely [11]:

- Set of maturity levels.
- A descriptor for the level, such as: initial, repeatable, defined, managed, and optimized.
- Summary description for each level, with its own characteristics and peculiarities.
- A set of process areas, dimensions, or both.
- A series of elements or activities for each process area and dimension.
- A description of each element or activity.

When assessing a company, the first step to be taken is to define the maturity assessment model that should be adopted. This will strongly depend on the resources available and the needs of the organization. After choosing, it is possible to obtain not only the maturity level of the organization but also allows the establishment of the level that it intends to achieve in the future [12]. In fact, there is no organization with a high level of maturity in practice [13]. But rather, organizations with purposes of reaching a different level of maturity, which fits their expectations. To reach the desired maturity level, it is required to analyse historical data and understand the critical sub-processes, to gain knowledge and establish feasible organizational improvement objectives for these sub-processes [14].

With this, the three main objectives of maturity models are: (a) identify where improvements are needed, (b) provide a guide to achieve a high level of maturity and (c) benchmarking between organizations [15]. There is a good base of studies supporting the complementary relationship between high levels of maturity, and improvement in organizational performance [16].

Having said that, for them to be able to understand the degree of maturity referred to above, and to understand their ability to manage projects successfully, multiple maturity models were created. Some will be presented in the next chapters [12].

2.1. PMMM – Prado Project Management Maturity Model

The PMMM maturity model, was first released in 2002 by Darci Prado [17]. Its initial intent was to serve as a tool to assist the author himself in providing consulting services. However, over the years it has become a project management maturity model used by several organizations.

Today, its objective is to provide a framework for organizational improvement, through the evaluation of the strengths and weaknesses of project management, enabling a comparative evaluation between organizations or sectors of the organization, as well as a measure of correlation between the level of project management of the organization and the actual performance of projects [18]. Apart from being simple, the model provides reliable and robust results for the successful execution of projects, being adherent to PMBOK, ICB and PRINCE2 [4].

Having said that, and given its structure, there are two different focuses: the sectorial and the corporate. However, regardless of the focus, both the sectorial and the corporate view are formed by five levels (Initial, Known, Standardized, Managed and Optimized), and each level can contain seven maturity dimensions (Technical and Contextual Competence, Project Management Competence, Behavioral Competence, Methodology, Computerization, Strategic Alignment, Organizational Structure).

Regarding implementation and evaluation, the model is employed by means of a questionnaire consisting of 40 multiple-choice questions, requiring only 60-90 minutes to complete [4].

2.2. KPMMM – Kerzner Project Management Maturity Model

Aligned with the Project Management Institute, the KPMMM emerged in 2001, because of years of research and fieldwork in organizations around the world by author Harold Kerzner. Is presented as an extension of the CMMI model and, for that reason is subdivided into 5 maturity levels [19]. Over the years, this model has proven to be effective and efficient, thus allowing the identification of the best practices executed in project management and opening doors for improvement opportunities. However, compared to other models, the KPMMM only provides the

percentage of maturity assessment instead of final scores, making it difficult to make recommendations for continuous improvement [20].

In this way, the model is endowed by a questionnaire involving 183 questions, which are subdivided by the levels, allowing to understand the maturity in each of them [1]. It is also important to note that, according to Monteiro et al (2015) contrary to other models the maturity levels in KPMMM can overlap, the extent of their overlap is mainly based on the amount of risks the organisation is willing to bear. Although overlapping is possible, the order in which they end cannot be changed.

2.3. OPM3 – Organizational Project Management Maturity Model

The OPM3 model, was emerged in 2003 by the Project Management Institute (PMI), and compares the organizational activities with the best practices, evaluating them in project, program, and portfolio management (domains), through the analysis of the capabilities (organizational activities identified as best practices), and the results (beneficial effects of the performance of these activities) [21], [22].

It may be useful to think about OPM3 considering three core points in its constitution: Knowledge, Assessment, and Improvement. These three points describe the key element of the model. In this way, Knowledge motivates Assessment, which in turn may drive Improvement. With this said, there are five steps that incorporate the OPM3 life cycle (Preparing the Assessment, Carrying out the Assessment, Improvement Plan, Implementing Improvement, Repeat Process) [21].

The progression of increasing maturity of the OPM3 model, consists of two dimensions. One dimension involves the best practices in terms of association with progressive levels of process improvement (Standardization, Measurement, Control and Continuous Improvement) [22]. And the other concerns the progression of best practices associated with each of the domains (Projects, Programmes and Portfolios). Each of these progressions forms a path along which all organisations aspire to advance.

It is also important to emphasise that the difference between this model and the others is that a classification by levels is not used, but rather percentage values [23].

In short, the benefits of using the OPM3 model are to assess and understand the best practices and capacity being implemented in the organization, avoiding deviations, and implementing the best solutions.

2.4. PMMMMSM – PM Solutions Project Management Maturity Model

The PMMMMSM first appeared in 2002 by the authorship of the consulting firm, Project Management Solutions, Inc. (PM Solutions). Its main objective, results in providing a conceptual framework within which specific processes can be optimized to improve organizational efficiency [3].

Regarding the structure, the PMMMMSM follows the logic of the ten knowledge areas of the Project Management Institute (2017) and is modelled after the tiered representation of the CMMI model. In other words, it results from the assessment of the implementation of the knowledge areas in an organization by means of the five maturity levels. This means that, the organization can develop and measure its capabilities regarding project management based on five maturity levels, for each of the PMI's PMBOK knowledge areas.

To realise the assessment, the model offers a self-assessment checklist designed to help understand in a simple and informal way the maturity of project management in an organisation. Allowing, a logical way forward and improving project management capability [3].

2.5. NPM3– National Project Management Maturity Model

The NPM3 first appeared in 2018 by the authorship of Seelhofer and Graf. Its main goal is to extend the field of organizational project management maturity, to national contexts. The authors argue that, from a national perspective, there is a low level of project management maturity in important industries, which is a cause for concern [24].

Based on the logic of the organizational model's structure, the NPM3 is also divided into maturity levels. In this case, four maturity levels were proposed (Born, Developing, Adolescent and Mature) [24].

In this way, the model is divided into a set of KPI's by the group of perspectives and the four drivers of maturity. Through the observation of 22 KPI's, respectively distributed in eleven for each of the approaches, it is possible to form a scale of points which allows the perception of whether the maturity in project management at national level is low, medium, or high. That is, each KPI for each approach is divided into a low, medium, and high maturity contribution [24].

To interpret the results, the author created a simple linear scoring system. Specifically, he chose to assign two values to high maturity, one value to medium and zero values to low. Assuming that, a high maturity value results in at least eleven high and ten medium contributions, and medium maturity in at least eleven medium and ten low contributions. Therefore, the overall scoring scale is defined by [24]:

- 32-42 points: high maturity in national project management.
- 11-31 points: medium maturity in management of national projects.
- 0-10 points: low maturity in management of national projects.

The above scale is not yet evidence based. And so, more research will be needed.

3. Research Methodology

In this paper, the research methodology used is called Design Science Research and was adopted to develop an analysis and decision support framework for the use and selection of a maturity model in project management.

Thus, DSR in Information Systems consists of six phases, which are described below through the framework of the topic [25].

The first phase, also known as problem identification and motivation, aims to define the problems encountered by the researcher and the benefit of their solution. Thus, it was possible to verify that the constant evolution of maturity models in project management, namely with the emergence of new models such as the NPM3, needs updates that accompany them to thus understand their use and benefits. This will allow future users of the models to understand the current differences through a set of variables.

In the second instance, the objectives of the solution are defined, in this case, it is necessary to define the objectives to achieve the solution. Thus, a study was made in several search engines, which allowed understanding the need for the creation of a framework that will allow the comparison of the current maturity models in project management. The fact that there is no study that globally compares these 5 models in the current conditions, should be highlighted.

Thirdly, the design and development of the solution previously explained is made. Therefore, variables were selected from which, three variables were excluded from the original framework, and two new variables were added (see section 4). This allowed the elaboration of the previously thought framework

After that, it is necessary to present the effectiveness of the solution. For this, the 5 maturity models were compared by means of the selected variables who's proved to be effective.

Subsequently, the initial objective is compared with the solution. And finally, the communication of the problem and the solution to the expert board is made.

4. Proposal of a framework for PMM models comparison

When one has in mind to choose a model to evaluate maturity, must consider in addition to the structure and resources of the institution itself, a set of decisive variables.

As mentioned above, an analysis was done on the search engines that allowed us to verify the veracity of the study conducted by Silva R., & Santos E. [5]. Thus, to the variables of the original framework (Understanding, Standard, Data, Evolution plan, Benchmarking Culture, Structure), although with slight linguistic differences, the variables Tested and Customizable were added. This derived from the fact that, firstly, the models could be new and therefore there is a need to contextualize this circumstance, and secondly, there are multiple organizations with different needs, whose adaptation of the model is irrefutable.

In this way, the framework consists of 9 variables, presented with their respective description and origin (Table 6).

Table 6. Proposal of a matrix for the comparison of maturity models

Variables	Description	Main Source
Understanding	Is the model simple or complex to understand?	[1], [26], [27], [28], [29]
Standard	The model was created following a standard or project management methodology?	[1], [26], [28], [29], [30]
Customizable	Does the model allow modifications to be made to fit the needs of the moment?	[1]
Data	What is the data collection mechanism?	[1], [26], [28]
Evolution plan	Does de model provide an evolution plan?	[1], [28]
Benchmarking	Does the model allow for benchmarking with other companies?	[28]
Culture	Does the model identify aspects of culture that contribute to maturity?	[1], [28]
Structure	Is the model divided through a scale?	[28], [31]
Tested	Has the functioning of the model been studied beforehand?	[1]

Thus, in the Table 7, it is possible to observe in detail the comparative evaluation between the models studied (Prado's PMMM, OPM3, KPMMM, PMMM from PM Solutions and NPM3) with the variables in Table 6.

Table 7. Comparative evaluation using the proposed framework

Variables	Analysis
Understanding	Regarding the complexity of the application, and about the OPM3 and KPMMM models, it can be noted that it has a medium complexity. This is because, in the former, the questionnaire applied is simple, however, it is repetitive and lacks a measurable maturity level, which makes it difficult to set objectives. And in the second, a deeper theoretical understanding is required, which may derive from the fact that the questionnaire is different from level to level. As far as the remaining models are concerned, the complexity is considered simple. Since in the PMMM SM the theoretical structure is easy to understand, and the questionnaire is simple and informal. In the Prado, the model is simple both to understand and to apply, and the questionnaire has only 40 questions. And lastly in NPM3, the model has a simple theoretical understanding, but not much can be said about its application because it is a recent model [26].
Standard	Regarding the foundation of the model, which can be project management standard or methodology, it is concluded that, OPM3, KPMMM and PMMM SM models show reference to PMI's PMBOK standard. In contrast in the Prado model, no standard reference was identified. However, it adheres to the terminology of PMBOK, ICB and PRINCE2. As far as the NPM3 model concerns, it is factual to state that its foundation shows reference to PMI's PMBOK standard. This is because, the basis of the perspectives is established on a set of knowledge areas of models that were created by means of the PMI's PMBOK.
Customizable	Regarding this aspect, there are several evidence that report research studies where, the models were adapted through the circumstances required for the study. As for NPM3, nothing can be reflected on this variable, as it is, once again, a recent model [32], [33], [34].
Data	With respect to the data collection mechanism, all evaluations can be carried out with the help of a questionnaire that can be answered by means of interviews or surveys. Except for NPM3, whose information requires numerical data collection from different organizations
Evolution plan	All models present guidelines for growth. The OPM3 offers a set of best practices. The KPMMM presents critical success factors for implementation. Prado recommends developing a growth plan by establishing strengths and weaknesses. The PMMM SM , allows verifying during the evaluation of a set of criteria that have not been achieved and should be reviewed and implemented. And in NPM3, it is possible through the KPI's to improve those that have a worse maturity, to denote, once again, that the model has not yet been scientifically proven.
Benchmarking	The Prado model is the only one that allows a comparative evaluation between companies of the same type. Through the website, it is possible to check a set of almost annual reports of these statistics. As far as the KPMMM model is concerned, although there is a reference about this parameter, it does not propose such studies.
Culture	All the models consider the culture of the organization except for the OPM3 model. However, according to Silva R., & Santos E. [28], aspects of this variable can be identified in the questionnaire of the OPM3 model.
Structure	All models propose an evolutionary scale of maturity identification. However, each one has certain characteristics that differentiate them. The OPM3 model presents a method for evaluating processes related to project, program, and portfolio management from aspects such as: knowledge, evaluation, and improvement. In KPMMM through a set of evolving levels turns it possible to evaluate project management in organizations. In Prado's PMMM, it is possible to assess the maturity level

with the respective adherence to the level and dimensions. In the PMMMSM, the assessment is made through five levels of maturity distributed by the knowledge areas of the PMBOK. And finally, the NPM3 is divided into four levels of maturity that, through a set of twenty-two KPI's distributed by the drivers and perspectives allow the assessment of maturity in project management at national level.

Tested It is possible to verify in multiple case studies that all models have been tested and used in real cases by various institutions or organizations. Except for NPM3.

According to the analysis, it was possible to verify that, regarding the variables: Tested, Culture, Evolution Plan, Data, Standard, and Customizable Prado's PMMM, Kerzner's KPMMM, OPM3 and PMMM from PM solutions are similar. Since all of them have already been tested, all consider the culture of the organization, even if not directly, they aim the proposal of an improvement plan, allow the collection of data through interviews, follow a referential even if it is not part of their rationale, and are adaptable.

However, regarding the Understanding and Benchmarking variable, the Prado PMMM model stands out. This is the model that is easiest to understand and apply and the only one that enables a comparative evaluation.

In relation to the Structure variable, all models except the OPM3 follow a division by maturity levels. Finally, and on the other side, the NPM3 model is the one that most departs from the rule, mainly because it is a recent model.

5. Concluding remarks

This article sought to compare a set of variables that would allow the evaluator to understand what is on the table. The objective was not to identify the best PMM model to apply, but rather to compare the main characteristics with the adapted framework.

Despite the above, the results of the analysis show that the Prado model is the most appropriate for a typical assessment. However, one should always consider all variables. Because, if for example, we talk about a larger scope, and if we want to assess not only maturity in project management but also in programs and portfolios, the most suitable model is OPM3. Because no other model refers to these parameters.

This study expects to contribute to the clarification and contextualization of the various PMM models. Knowing the importance of project management maturity for the success of companies, we also expect to contribute to facilitating the selection of the most appropriate model in specific areas.

As for the limitations of the study, it was observed that, since the NPM3 model is recent, there are still no cases of implementation, which restricts the collection of information for comparative evaluation. Thus, it is recommended that in future studies a new analysis of these variables be carried out, since new models are always appearing, and the existing ones are constantly evolving.

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