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Maturity analysis in project management in Colombian universities

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Abstract. Project management has become a worldwide trend within organizations seeking continuous improvement of their processes, where maturity models for project management play an important role. The general objective of the research is to evaluate the degree of maturity in project management in order to propose strategies to improve the organizational culture in project management. The selection of the maturity model that fits the organizational context is carried out, then an analysis is made of the management of those involved and the management of communication in project matters, the degree of maturity is measured, and then strategies for improvement are selected. As a result of the research it was obtained that reaching a level of maturity implies obtaining results from a measurement and comparing them with a previously established standard, in order to implement best practices, reach a higher level of scale or continuously improve their processes. However, it should be borne in mind that reaching maturity involves a gradual process, senior management support, time and a highly trained team.

1. Introduction

Currently, project management has had an impact on organizations seeking continuous growth within their processes, applying methodologies that allow them to have a gradual and efficient improvement. For the Project Management Institute (PMI), in the Project Management Body of Knowledge (PMBOK), project management is the application of knowledge, skills, techniques and tools to the activities of a project, with the aim of developing best practices at the global level of projects [1]. On the other hand, personal and organizational maturity is usually accompanied by self-criticism; the immature subject (person, group, organization) is highly egocentric, and the more egocentrism, the less self-criticism [2]. Likewise, it is important to understand maturity as the degree of perfection or the level of total development of a person or organization [3]. Models of maturity are created in order to determine under a scale the level or degree of maturity in which the person or company is and thus motivate the gradual growth to rise from levels of maturity to reach a higher one. Interpreting the level of maturity as the number of phases of a model indicating a state [4].

Likewise, the organization must apply a model that fits its organizational context with which it can evaluate maturity, culture, human capital, technological tools, and project portfolios [5]. To evaluate maturity in project management over time, different models have been developed, such as Harold Kerzner's Project Management Maturity Model (PMMM), which consists of 5 levels and is applicable

to all types of organizations [6], the application of these levels allows the transition from an immature organization to a mature one [7], the Capability Maturity Model (CMMM) whose objective was to measure the maturity of software development processes, composed of 5 levels developed consecutively [8], for its part, the Project Excellence Model (IPMA) is based on the conceptual foundations of Total Quality Management (TQM), raises 5 levels and 6 dimensions [9], or the Organizational Project Management Maturity Model (OPM3) developed by the PMI that has 3 dimensions, the management domain, the practice of improvement processes and Project Management processes [10]. Research conducted by different authors applying the PMMM methodology in companies such as SYSDE [11], ICE Project Organization [12] and COBISCORP [13], has shown their performance, points for improvement, organizational needs, senior management support and the progress or setback in project management practices.

On the other hand, the management of those involved has the purpose of identifying and determining how the interested parties are affected, propose communication strategies and manage their expectations; therefore, it is indispensable to consider each of the internal or external authors who have some type of influence in relation to the projects [1].

2. Materials and methods

2.1. Maturity model
To determine the most suitable maturity model to be applied, a comparative analysis of the models presented in the theoretical framework was carried out in order to identify characteristics, benefits, advantages and adaptability for the organization. This analysis takes into account the CMM, PMMM, also known as the Kerzner model and the OPM3 developed by PMI.

2.2. Stakeholder management plan
For the analysis of those involved, the group of actors that have an interest in the development of the projects, directly or indirectly, is determined internally and externally; Figure 1 shows the list of those involved analyzed. Based on this information, a prioritization of the stakeholders is carried out, determining the relation power/interest, influence/power, considering four variables. Degree of interest, power, influence and impact, as illustrated in Figure 2 and Figure 3.

INVOLVED
Dean
Department Directors
Program Coordinators
Program coordinators
Teachers
Faculty Council
Academic Vice Rectory
Vice-Rectory for Research
Vice-Rectory for Social
Interaction
Planning Office
COLCIENCIAS

Figure 1. List of those involved.

2.3. Evaluation of the degree of maturity
Through the application of Harold Ketrzner's PMMM maturity model, adapted by Manuel Álvarez, a questionnaire of 7 sections is applied, distributed in maturity, methodology, tools, competencies, portfolio, multi-projects and PMO. For the analysis of the maturity level of each section, Table 1 will be taken into account.

2.4. Improvement strategies
Based on the results of the maturity evaluation obtained, it was determined that the Faculty studied is at level 2 of the scale of the PMMM model, therefore, a series of actions for improvement are proposed that aim to increase the level of maturity in Project Management.

To scale up within the levels of the model it is necessary to recognize weaknesses, overcome obstacles, make changes in project management that lead to the use of best practices and increase the probability of success in the development of projects.

Figure 2. Power/interest matrix.
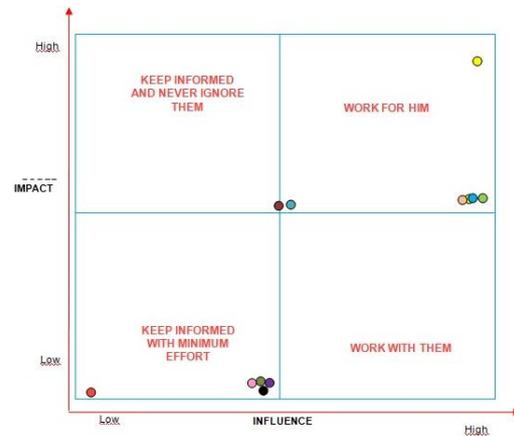
Figure 3. Influence/impact matrix.

Table 1. Maturity level section.

Percentage (%)	Level
0 to 33	Bass
34 to 50	Medium Low
51 to 66	Medium High
67 to 100	High

3. Results and discussion

3.1. The maturity model
The maturity model that best adapts to the requirements raised and that will allow the evaluation of the different processes in the institution is the PMMM for the following reasons: This model is related to the project management standards provided by the PMI. Involves the evaluation of organizational processes and culture. It takes into account human and social capital as key factors. Low application cost and complexity. The evaluation tool is practical and flexible, so it can be adapted to the needs of the institution. The results obtained are analyzed using the ranges and levels established by the model. It allows to propose improvements in the organization, in a clear way in order to advance in the levels of maturity. Levels can overlap, allowing them to progress without having to finish one level to continue to the next.

3.2. The matrix of stakeholders
The matrix of stakeholders is a tool used to compile, classify, analyze and rank all those involved in the project, considering the levels of interest and influence, and will also allow strategies to be proposed to achieve the objectives set around the project. As shown in Table 2.

3.2.1. Involved. Name that identifies the interested party.

3.2.2. Type. Role played can be internal (I) or external (E).

3.2.3. Interest. Approaches that are directly related to the current situation.

3.2.4. Strategies. List of actions to be implemented to obtain support and avoid obstacles during the implementation and closure of the project.

Table 2. Stakeholder matrix, strategies to follow with stakeholders.

Involved	Tepee	Interest Strategies	Interest Strategies
Dean	I	To comply with the guidelines established by the institution at the academic level, accreditation and self-evaluation, ensuring the proper functioning and progress of the faculty based on technological development and social interaction.	Select an interdisciplinary team. Train and motivate staff in project management. Hold periodic meetings to monitor and control the processes of the faculty in reference to the projects. Strengthen academic development and research groups.
Department directors	I	Encourage good conditions for students and teachers. Direct the proper functioning of the programmers under their responsibility. Manage resources for the procurement of machinery, equipment, specialized software and training	Train and motivate staff in project management. Hold periodic meetings to monitor and control the processes of the faculty in reference to the projects. Strengthen academic development and research groups. Strengthen research groups Encourage the use of new technologies for the dissemination and application of knowledge. Conduct regular process control meetings.
Program directors	I	Leading program processes. Strengthen the academic, research and professional training processes of students. To be recognized before Colciencias with research groups and seedbeds. Carry out modernization of curricular content.	Motivate teachers to participate in faculty processes. Make assertive communication. Fostering a good working environment Manage resources to develop projects. Establish agreements with companies.
Program coordinators	I	Strengthen the academic, research and professional training processes of students.	Motivate teachers to participate in faculty processes Make assertive communication Fostering a good working environment Establish agreements with companies.
Teachers	I	To be recognized before Colciencias with research groups and seedbeds.	Submit research proposals internally and externally. Participate in business university projects. Encouraging research from the classroom.
Faculty council	I	Make decisions on all cases (inconveniences, needs, projects, agreements, design of extension programs, etc.) presented by programs, teachers and students.	Form an interdisciplinary group with teachers and students. Hold regular meetings to study and approve cases. Linking the different programmers in multidisciplinary projects.
Academic vice rectory	E	To regulate all the academic activity of the Institution. Evaluate academic training processes. To advise faculties in the planning and design of academic development plans, policies and projects. Identify, formulate and design projects to improve academic quality	To prepare and present draft budgets for the Vice-Rector's Office To promote, organize and advance, according to the needs of the unit, comprehensive welfare and training policies, plans, programmers and projects for the personnel under its charge.

		at the University of Pamplona. Coordinate and evaluate institutional self-assessment and accreditation processes.	Manage internal and external resources for project development.
Vice-Rectory for research	E	Promote the design of research projects, taking into account technological developments, knowledge and innovations. Follow up on research projects. To attend with social responsibility to local, regional, national and binational needs and interests.	Constantly inform about internal and external research calls for proposals. Conduct training in strengthening research. Update the information on the institutional website platform.
Vice-Rectory for Social Interaction	E	Articulates academia, research and social interaction to integrate different areas of knowledge. Strengthen participation in technology management processes. To carry out programs and projects of social interaction integrating the university community to carry out the processes of project management, continuing education, graduates, inter-institutional and international relations, promotion and marketing.	Design mechanisms for interaction between the community, business and the university. Maintain communication with alumni. Create agreements with social, institutional, economic and professional sectors.
Planning office	E	Advise on business processes. Verification and control of allocation of items for the development of projects. Monitoring and controlling compliance with the development plan, investment plan and institutional action plan.	Clearly inform the protocols of the processes. Train the institution's staff in the use of planning tools. Disseminate information through institutional means.
Colciencias	E	To carry out national calls for projects that strengthen research, technological development and/or innovation. Carry out recognition and classification of research groups.	Publish research calls constantly through the website. Update information from researchers and research groups. Design policies for research, technological development and innovation groups and centers.

3.3. Maturity level

Once the results for each section are obtained, they are graphically represented as shown in Figure 4, determining that the level of maturity for the person empowered is medium-high, corresponding to 61.5%.

The total score obtained is 320 out of a possible 640, taking into account the ranges in Table 1, this value indicates that the faculty is at the limit of the Lower Medium Maturity Level. This allows us to detect weaknesses in the sections, propose improvement actions and strengthen strengths.

3.4. Plan of actions

This plan establishes the actions in an organized manner for each level, stipulates the short and medium term implementation, described as follows:

3.4.1. Level 1: Common language. Creation of the PMO, establishment of minimum requirements and parameters of the human resource profile assigned to the projects, carrying out effective and assertive communication processes.

3.4.2. Level 2: Common processes. to train selected personnel in project management under PMI methodology, to promote the use of technological tools, to manage training in management, leadership, high performance, coaching, etc. Hold meetings to monitor the progress of the project.

3.4.3. Level 3: Unique methodology. Review and implement methodologies in project management, standardize processes, review methodologies and audits in project management. Carry out an internal marketing plan in relation to project management to generate project culture. Identify opportunities for improvement and make processes more efficient.

Level 4: Benchmarking. To carry out a comparative program at the level of research, documentation, performance, knowledge and good practices. Feedback to stakeholders, identify weaknesses and opportunities for improvement, gradually incorporate a methodology. Make changes as a result of lessons learned and requirements previously analyzed.
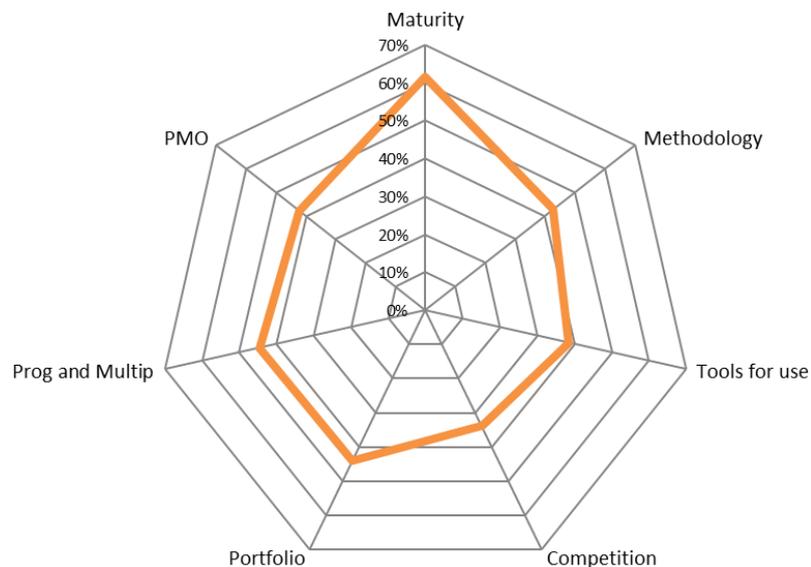

Figure 4. Maturity level graph**.**

4. Conclusions

Organizations must be prepared to adapt quickly to changes, therefore, the importance of using tools that provide the necessary information for decision making. In the case of the faculty of engineering and architecture, taking into account its resources, technology development, organizational and learning capacity, a model is required that defines it at the level of its structure, intellectual capital, human capital, information systems, methodology and processes. In addition, it should be the reference point to determine strengths, opportunities, threats, weaknesses, compare results and detect areas for improvement.

The Kerzner-PMMM model allows you to evaluate maturity aspects of projects across five levels, common language, common processes, unique methodology, comparison, and continuous improvement. It can be applied to any type of organization, allowing for easy progress in the levels and overlapping of the same. The maturity level of the engineering faculty is medium high, corresponding to 61.5%. Through the application of the areas of knowledge in stakeholder management, the actors involved in the implementation of faculty projects were identified.

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