Methodology for Organizational Gain in Project Management Maturity

Dulcinéia Gonçalves Ferreira Pires[1], Messias Reis Da Silva[2], Sandrerley Ramos Pires[2]

(1. Instituto Federal de Goiás, Campus Senador Canedo, Brazil; 2. Universidade Federal de Goiás, Brazil)

Abstract: The analysis and diagnosis of the maturity level in project management in an organization is an important action to improve its processes in this area. the obtained diagnosis is the starting point for improving the maturity level in this organization. with it, it is possible to apply improvement actions, which need to be considered and prioritized so that the process of gaining maturity is as fast and productive as possible. the process explained in this paper has three steps. the first one is the diagnosis of the company's maturity level. the second one is the analysis of the causes that led the organization to have that degree of maturity. and, finally, the last step is the enumeration of actions to mitigate the identified causes. it is expected that with this methodology the company will gain maturity in project management. in addition to this proposed methodology, the work carries out a case study to show the effectiveness of the proposed process. the results obtained in the case study show that the proposed methodology contributes decisively to the gain of maturity in project management.

Key words: project management; maturity in project management; Ishikawa diagram

JEL code: L

1. Introduction

An ever-desired goal in an organization is to reach the maturity stage in project management. This stage ensures that the organization's strategic steps are much more likely to be taken correctly and efficiently. However, it is not always so simple to achieve this desired maturity level since multiple factors and with multiple origins can impact the process of achieving it.

In general, the search for maturity in project management is made by a diagnostic process of the organization, followed by the analysis and determination of the factors that had a negative impact on the obtained diagnosis. With the list of negative factors, the organization must enumerate, prioritize, and carry out actions to mitigate the problems encountered. Thus, observe a paradoxical situation, the gain in project maturity is obtained by carrying out projects for this purpose. This situation suggests that maturity gain projects must have their steps very well defined in a document, that is, a specific methodology for that purpose.

This work aims to establish a process for gaining of maturity in project management. To this end, the paper presents a methodology to support an organization that wants to obtain this maturity. The process describes how the organization diagnoses your skills in project management, obtaining a set of improvement actions to be carried out,

Messias Reis da Silva, Specialist, Instituto Federal de Goiás; research area: project management. E-mail: messiasreiss@hotmail.com.

Dulcinéia Gonçalves Ferreira Pires, Master, Instituto Federal de Goiás; research areas: software engineering, image processing, and project management. E-mail: dulcineia.pires@ifg.edu.br.

Sandrerley Ramos Pires, Doctor, Universidade Federal de Goiás; research areas: artificial intelligence, image processing, and project management. E-mail: sandrerley@ufg.br.

cyclically, until the desired maturity is reached by the organization.

The proposed methodological process is based on the use of known and widespread techniques. To perform the diagnosis of maturity, the proposed methodology uses the method of Prado (2010). For the analysis of causes that prevent maturity stage, the Ishikawa diagram is used (Ishikawa, 1990). For the determination of actions that can potentially mitigate the causes found, the methodology uses the Case Based Reasoning (RBC) technique (Wangenheim et al., 2013).

The article shows in a section 2 a theoretical basis of the used techniques, in section 3 it shows the methodological proposal itself. In section 4, a case study presenting the results obtained with the methodological process proposed. Finally, in the section 5, presents the conclusions of this work.

2. Theoretical Framework

To facilitate the reading process of this article, this section presents a small theoretical framework to contextualize the techniques involved in the proposed methodology. The section discusses project maturity and the Ishikawa diagram.

2.1 Concept of Maturity in Project Management

The concept of maturity is connected to several human factors, but in short, in the professional context, it indicates how experienced a particular person is to perform a certain job or activity (Super, 1983).

In the context of project management, maturity is linked to how capable an organization is to manage and execute its projects (Prado, 2010). It is important to know that managing several projects over a long period does not guarantee an increase in maturity. If this management is not being carried out in accordance with organizational desires and within a standardization, there is hardly any gain in maturity. Prado (2010) also states that a maturity model is, then, a mechanism capable of numerically quantifying the capacity of an organization to successfully manage its projects.

For Kerzner (2006) maturity in project management is the development of systems and processes that are repetitive in nature that guarantee a high probability that each performed project will be a success.

2.2 Maturity Model in Project Management

This model was proposed by Prado (2010) and aims to quantify a score that indicates the maturity of the organization in relation to the project management (PM) activity. The model consists of seven dimensions, namely:

1) Competence in project management: this dimension identifies the capacity of those involved in PM to act according to a methodology.
2) Technical and contextual competence: those involved with PM must be competent in technical aspects related to the created product.
3) Behavioral competence: those involved with PM must be competent in behavioral aspects such as leadership, organization, motivation, and negotiation.
4) Strategic alignment: this dimension evaluates whether the projects carried out in the sector are in full alignment with the organization's strategies.
5) Methodology: it verifies existence of an adequate methodology for project management which consider the entire cycle that needs to be followed.
6) Computerization: this step verifies relevant aspects of the methodology that must be computerized.

7) Organizational structure: this dimension verifies the organizational structure that must be in use, both for the business operation and for the Implementation of maturity gaining stages.

The dimensions of the methodological model can be seen in Figure 1(a). The layout of the dimensions in the figure shows how they are related. Some dimensions support the others and, overall, they support the organizational structure and leverage project management in the organization.
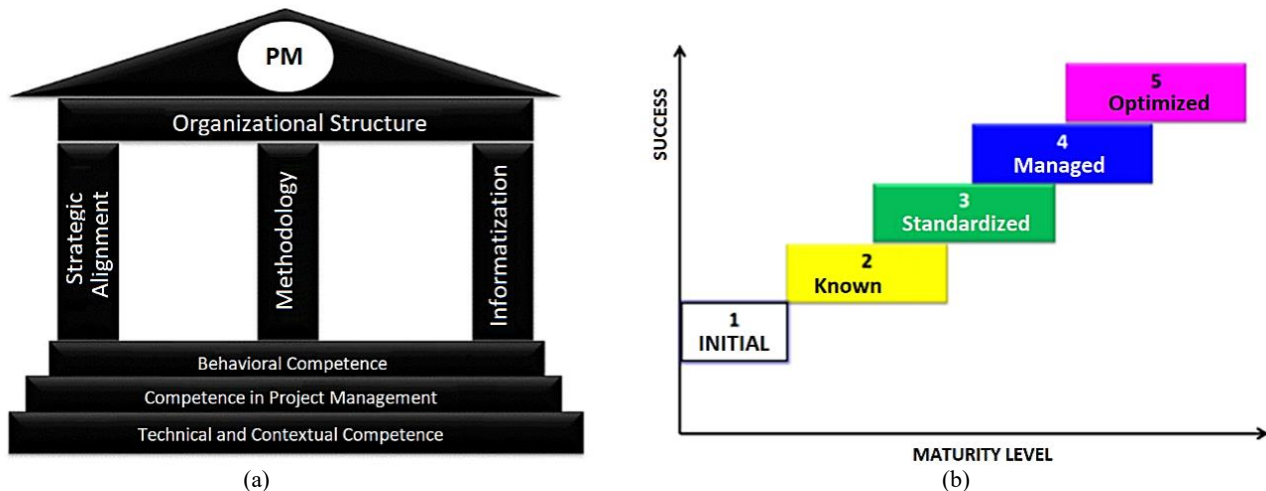

<div align="center">(a)   (b)</div>

Figure 1   (a) Dimensions of the Methodological Model. (b) Maturity Levels.

Source: Prado, 2010

The model allows measuring the project management capacity at five levels, which are:

Level 1) Initial: the company does not have a correct perception of what projects and project management (GP) are.

Level 2) Known: it is the awakening for the direction of project management.

Level 3) Standardized: situation in which a PM platform was implemented.

Level 4) Managed: this is when the PM platform really works and gives results.

Level 5) Optimized: represents the situation when the PM platform not only works and gives results. This level is optimized by the practice of continuous improvement and technological and process innovation.

The maturity levels are shown in Figure 1(b). Note in the figure that relationship between maturity degree and success reached defines the level of company in the project management task. The Level 5, the optimized, should be the goal of any company that seeks to improve its project management capability.

The result of that level is obtained through the application of a questionnaire composed of forty questions that analyzes the seven described dimensions. There are four group of ten questions, which are applied to levels from two to five. The level one is just goodwill, dispensing with a set of questions for its identification. After this evaluation process, the Prado (2010) method calculates a score from 1.0 to 5.0. and, finally, this score will define the maturity level of company.

2.3 The Ishikawa Diagram

This is a diagram created in the 60s by Kaoru Ishikawa (Ishikawa, 1989) that aims to map cause-effect relationships. It is a tool from the quality area that allows analyzing the execution of a process mapping the factors which generated some undesired result. With this diagram it is possible a systemic vision of the process, acting over it to increase its quality.

The Figure 2 shows an example of an Ishikawa diagram. In this example, the diagram aims to identify the possible causes that leaded to a manufacturing defect in a product. The figure shows that the diagram allows to map a structural classification of the types of causes that can influence the result. This classification helps in the problem analysis process, as well as allows you to prioritize which causes will be attacked first.

2.4 Case Based Reasoning

For the solution of a new problem, it is useful to seek knowledge acquired that already solved similar problems. To reuse the knowledge, it is necessary that it had been learned, indexed, and stored in a knowledge base (KB). An important technic that permits to accomplish this kind of activity is the Case Based Reasoning (CBR) (Wangenheim et al., 2013).
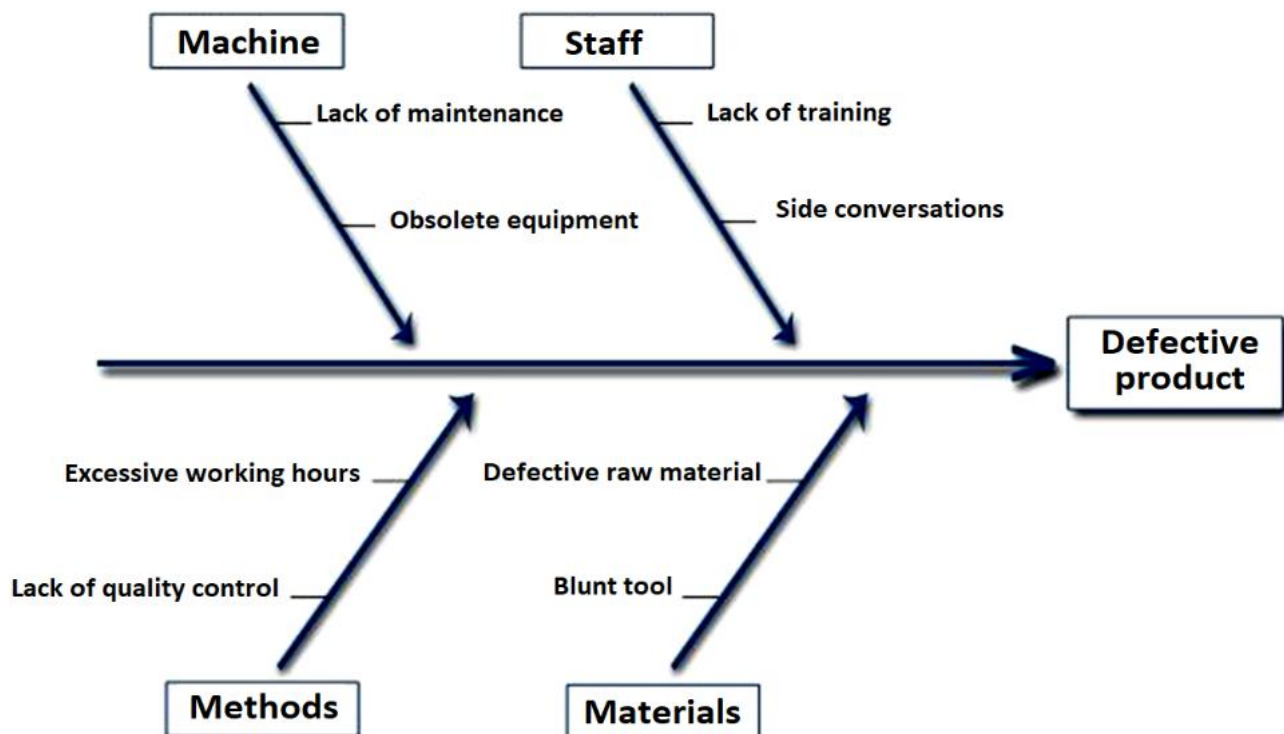

Figure 2 Ishikawa Diagram

Source: Blog da Qualidade

As each new problem may not have the same solution as the previous similar problems. But it is possible to use partially the saved knowledges, adjusting them to the new problem. The CBR has its principle in observations of human knowledge, of the memories and of the learnings that they passed. When a person face with a new problem, the experience obtained along the time is used to try to solve it.

When a new problem is identified, a search is made at BC looking for a similar stored solution that can solve the current problem. The solution of a case that is like the current case should be sought. The model for the CBR process used in this work was proposed by Aamondt and Plaza (1994). It has four tasks:

1) Recover: perform the recovery of similar cases stored in the database.
2) Reuse: it adapts the cases stored in BC to solve new problems.
3) Review: review of the proposed and adjusted solution to identify whether it is the best one to adopt.
4) Retain: retention of the experience acquired to be used in future problems.

3. Methodology for Maturity Gain in Project Management

In total alignment with the objective proposed in this work, it is considered that having maturity in project management includes two main elements. The first is to achieve managerial efficiency in projects. The second is to develop the ability to draw improvement plans to constantly improve the organization. Achieving this status leads to success in project management and, consequently, in their results.

The lack or low maturity in project management can be linked to several factors, which points to a need to identify the elements that can hinder the search for success. The ideas discussed in the previous section led us to the perception that having maturity in project management is having clear standards for project management. In addition, it is having a procedural mechanism capable of quantifying how efficient the company is in managing its projects within predefined success criteria. Finally, this mechanism should indicate ways of working towards the continuous increase in maturity.

Thus, this work proposes a methodological process that uses, primarily, the concept called Project Management Maturity Model (PMMM) (Prado, 2010). This step deals with obtaining a broad diagnosis of the organization, in its five levels, which will guide the other steps of the methodological process. The second step is to carry out an analysis of the reasons that led the organization to obtain the assessment marks. The various causative factors are mapped and structured within an Ishikawa diagram. Finally, actions for gaining maturity are defined. The focus is that in the next diagnostic cycle, the organization will have a better assessment of its project management maturity. The process of defining the actions to be taken uses a knowledge base that must be structured over time, allowing past experiences to be useful in the future.

The MMGP aims to identify the current conditions of the organization, identifying the level of maturity obtained. The Ishikawa diagram helps in determining the causes of the current stage and in delimiting the horizons to be thought of in search of growth. This activity leads to the development of a growth plan that allows greater maturity to be reached, starting from the levels now discovered.

Looking for the growing of the maturity level in project management, this paper created a methodological process which establishes some basic steps for carrying out the process. They are:

1) Survey of current maturity, via PMMM, involving the collection of information in the various areas of the company which are involved with project management activities.
2) Definition of goals for future horizons, based on the obtained results in the first measurement.
3) The construction of the Ishikawa diagram, aiming to group the causes of the possible falls in maturity.
4) Analysis of the diagram and the establishment of goals to be achieved in the next horizons. It is checked in the knowledge base of past cases to take advantage of successful actions already used in the past.
5) Storage of the actions taken, as well as recording the results obtained in the knowledge base. This knowledge could be used in similar problems in the future.
6) Carrying out new measurements at predetermined periods.

After this sequence of steps described for the proposed methodological process, the organization proceeds to carry out the planned actions. It is hoped that such procedures can increase the maturity of the organization as the environment and the people who work there evolve. The six steps are repeated until reaching the planned maturity level.

The structuration of a cases base (knowledge base) with problem mitigation actions may be, in the future, important source of experience for solving new cases. Although each company has its specificities, it is possible

that there is much similarity with one another. The application of CBR (Wangenheim et al., 2013) tends to make the methodology better applicable over time.

3.1 The Method Application

To verify the effectiveness of the proposed methodological process, a case study was carried out in a dairy company in Goiás, Brazil. The organization's data will be preserved for reasons of ethics, confidentiality, and information security.

When carrying out the survey, the result obtained for the maturity level of the analyzed area was 1.5 on a scale ranging from 1.0 to 5.0. The survey was carried out through the application of a questionnaire with forty questions and five alternative answers, with "A" being the best situation and "E" being the worst. These questions were taken from the work of Prado (2010). The overall score obtained is an average of the various dimensions that the model represents, not having a broad meaning, it only indicates the severity of the problem to be treated.

The grade 1.5 obtained shows that the level of maturity in project management in the analyzed area is at significantly low levels. The graph shown in Figure 3 shows the number of responses per letter, within the possibilities (A, B, C, D and E). It can be seen in the graph that most of the responses tended to the "D" concept, which is the second worst on the scale.

This massive presence of responses with letter D, where the objective to be achieved is always A, clearly demonstrates the low level of maturity. In this situation, each answer needs an analysis to determine whether the short-term objective will be to obtain the letter C, B and when it would arrive at A.

According to what was proposed in the work, a new measurement was scheduled. But, before that, it is necessary to carry out the analyzes of the identified scenario, the selection of corrective actions, the prioritization of these actions and the effective execution of the actions.
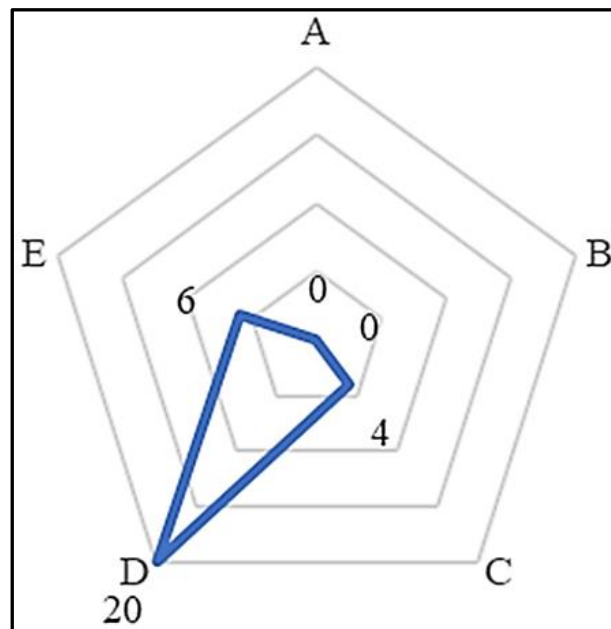

Figure 3   Number of Responses Per Letter

Figure 4 shows that, for each result obtained, a goal is drawn for the next horizons. Question No. 01 under analysis asks the following content: "In relation to the internal and external training that took place in the last 12 months, related to basic aspects of project management, tick the most appropriate option". The answer options for the question are:

1) A: several elements of the sector participated in training in the last 12 months. The training addressed aspects related to areas of knowledge and process management (such as the available standards, PMBOK, IPMA, Prince2 etc.).
2) B: the existing situation is slightly inferior to that presented in item A.
3) C: the existing situation is significantly lower than that presented in item A.
4) D: Efforts have been initiated in this regard.
5) E: No effort has been initiated in this regard.

Question	Letter	1º Metering	Goal 2º Metering	2º Metering	Goal 3º Metering	3º Metering	Goal 4º Metering	4º Metering	Goal 5º Metering	5º Metering	Target
	A	0	0	0	0	0	x 10	0	x 10	0	80%
	B	0	x 7	x 7	x 7	0	0	0	0	0	60%
1	C	x 4	0	0	0	0	0	0	0	0	40%
	D	0	0	0	0	0	0	0	0	0	20%
	E	0	0	0	0	0	0	0	0	0	0%

Figure 4   Question With Answers and Objectives for the Next Evaluation

As it is a question that requires subjective analysis to answer, an adaptation to the model was carried out. The word "several" present in answer "A" was adjusted to "at least 80%" in the "Target" column. In this case, it is understood that it will only be considered that the maturity level cited in the question will be in "A" only after 80% of those involved with project management have been trained.

In the first measurement in question 01, the letter "C" was marked, which is equivalent to 4 points. The score for each letter ("A" to "E") in the answer is, respectively, 0, 2, 4, 7 and 10. It can be noted that for the second measurement, the goal is "B", keeping the same in the third measurement. Only after the fourth measurement is it sought to reach "A", with a focus on maintaining the fifth assessment.

This procedure illustrated in this work for question No. 01 was carried out for all forty questions provided for in the diagnostic process described by Prado (2010).

To facilitate the analysis of the results and to discover the causes that lead to the evaluation of 1.5 in maturity, the Ishikawa diagram was then elaborated. The objective is to identify the points where actions should be focused to achieve growth in project management maturity. Figure 5 shows the Ishikawa diagram with the list of cause-effect relationships studied in the organization.

The use of the Ishikawa diagram made it possible to identify several problems that lead to low maturity in Project Management. The use of the questionnaires used allows linking the answers to the causes of the problem.

Twenty-five causes were identified that together are preventing the increase in maturity in managing projects. To define a prioritization in the search for solving problems, a graphic tool shown in Figure 6 was used. The graphic presented allows the classification of the identified causes, from the most numerous to the least impactful.

As can be seen in the graph, the creation of a culture in project management in the company must be prioritized. It is the first action to have an environment where everyone is involved and committed.

It is important to address issues related to the need to create indicators to measure the quality of project management in the organization. There is a need for training people and creating methods and procedures to support project management in the company. Finally, there are the materials, which in this case are represented by computational tools to support project management.
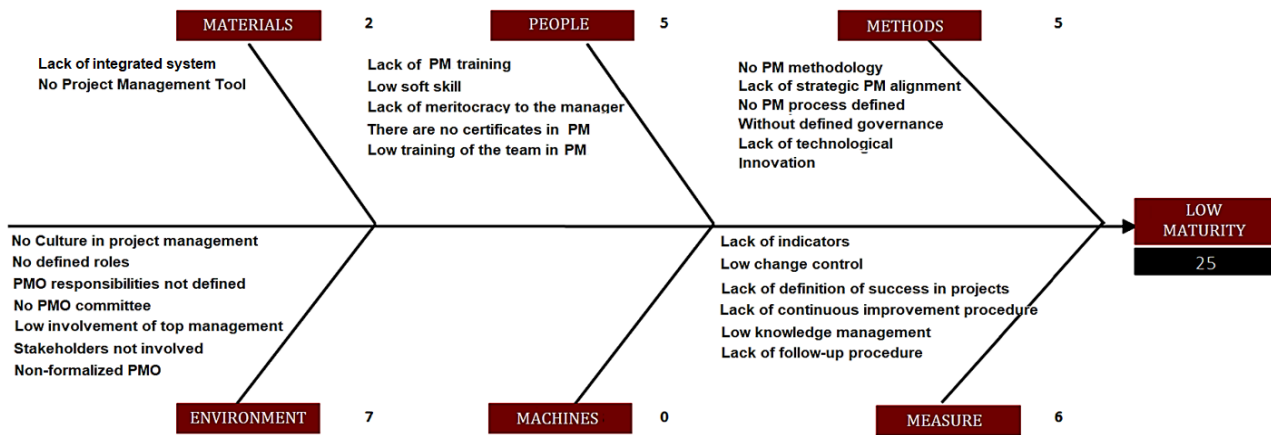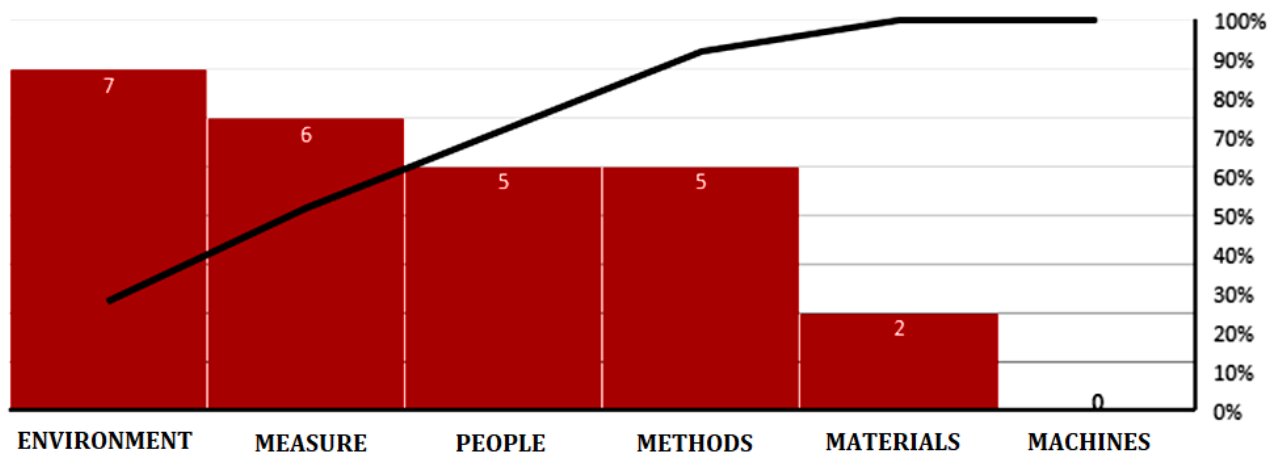

Figure 5   Ishikawa Diagram Obtained in the Evaluation

Figure 6   Ordering of Causes

3.2 Analysis of Results

The obtained results shown the identification of a several factors which indicate deficiencies in the organization. These factors must be treated to increase its level maturity. In possession of these deficiencies, it is possible to enumerate correcting actions and prioritize them to obtain an action plan for the company process refinement.

As two measurements were made, there was growth taking place from one period to the next. Thus, it is believed that the Ishikawa diagram initially set up was sufficient to identify the main actions that should be taken.

The diagram showed twenty-five problems classified by the six aspects that make up the structure of the diagram. The belief deposited in the methodological process is that, when all or a good part of the problems are eliminated, there will be a substantial growth in maturity.

The representation of causes and effects (problem map) in the diagram allowed a clear planning of actions to be implemented to be established. The actions taken were obtained from an initial knowledge base based on past

cases developed by the author. Being them:

3.2.1 Materials

1) Create an information system that enables the management of projects, programs and portfolios, and the communication of project status and indicators.
2) Standardize the use of a schedule tool that may be common knowledge among users and stakeholders.

3.2.2 People

1) Training for the team in Project Management.
2) Development of non-technical skills in Project Managers.
3) Develop meritocracy system for Project Managers and teams.
4) Certify Project Managers and team members in project management.

3.2.3 Methods

1) Create a methodology for Project Management and use it.
2) Align projects to the organization's strategic objectives, both for ongoing projects and for new ones that enter the portfolio.
3) Map the project management processes.
4) Define governance for projects. Documentation and procedures.

3.2.4 Environment

1) Create a project management culture and disseminate it to those involved.
2) Define roles for Project Managers, team members, sponsors, and stakeholders. It may be through a standard or operational procedure.
3) Create a Project Management Committee, which can be a Project Management Office.
4) Involve top management in project routines through periodic meetings.

3.2.5 Measures

1) Create indicators to measure projects, programs, portfolio, and adherence to the methodology.
2) Create change control.
3) Create project success criteria and define pilot projects to test.
4) Create a continuous improvement procedure based on the maturity raised.
5) Create a procedure for collecting and recovering lessons learned from projects, establishing knowledge management in the company.
6) Create a procedure for monitoring projects according to their complexity and duration.

When setting the goals for the next evaluation cycles, gain of maturity is expected. The Figure 7 shows the goals for next cycles. Once it reduces or eliminates the unwanted negative effects it is expected the gain of maturity in project management.

In the graph at each evaluation a growth in maturity is expected, which will only be proven with the application of the appropriate adjustments defined by the proposed methodology.
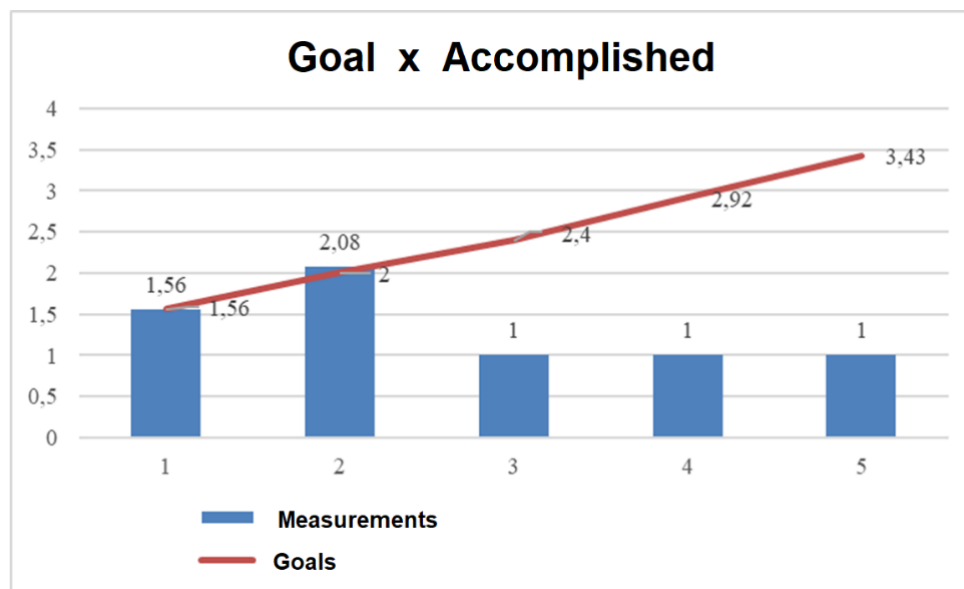
Figure 7   Graph of the Result of Two Evaluations Carried Out and of Future Goals

4. Final Considerations

It can be seen when analyzing the results obtained that the proposed methodological process could generate a set of basic directives to seek an effective gain in maturity in project management. This occurs by correcting several aspects in the analyzed organization.

The proposed methodology provides a global view of maturity, details of the problems that lead to diagnosed maturity and, mainly, a set of guidelines for the solution of the problems encountered.

The methodology manages to systematize the problem so that it can be treated by management actions. Methodology will not be the element that will lead to the growth of maturity. It takes a lot of training and internal organization effort for the gains to appear.

The realization of the case study in two cycles generated a set of actions that are evaluated and registered in a knowledge base. In the future, such actions may be used when applying the methodology in other organizations.

References

Aamodt A. and Plaza E. (1994). "Case based reasoning: Foundational issues, methodological variations, and system approaches", *AI Communications*, Vol. 7, No. 1, pp. 39-59.

Ishikawa K. (1989). *Introduction to Quality Control*, Springer Netherlands.

Blog Da Qualidade (2019). https://blogdaqualidade.com.br/diagrama-de-ishikawa/, acessado em 17/06/2019.

Kerzner H. (2006). *Gestão de Projeto: as Melhores Práticas* (2nd ed.), Bookman,

Prado D. (2010). *Maturidade em Gerenciamento de Projetos* (2nd ed.), INDG.

Super D. E. (1983). "Assessment in career guidance: Toward truly developmental counseling", *Personnel and Guidance Journal,* Vol. 61, No. 9, pp. 555-562.

Wangenheim C. G. von, Wangenheim A. Von, and Rateke T. (2013). *Raciocínio Baseado em Casos* (2nd ed.), editora Bookess.