






A methodological proposal through the comparison of methodologies for the implementation of innovation projects

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Abstract—A methodological proposal is presented to achieve the adequate implementation of innovation projects in a technology services company located in the northwest of Mexico, in which it is possible to identify and adapt project management methodologies based on the comparison of methodologies classified as traditional and agile, as well as their relationship with knowledge management. Firstly, it began with the analysis of the current situation, followed by the identification of existing methodologies and standards, their comparison and finalizing with the selection and/or adaptation of the methodologies. With the implementation of the proposal mentioned above, the expected result is to meet the dates and commitments established in each project and to increase customer satisfaction.

Keywords—Project management, Innovation, Methodology, Knowledge management

I. INTRODUCTION

In a world of constant change and increased competition that is driven by globalization and the advancement of economies, innovation becomes an important element. The ability to innovate is one of the key characteristics of competitive, dynamic and progressive organizations [1]; it allows the generation of fundamental values and beliefs that guide employees to convert knowledge into new intellectual assets [2]. Knowledge management plays an important role in the success of organizations' activities and strategies; it is considered a key element for organizations seeking to obtain a competitive advantage [3].

Organizations face a context where project management is increasingly relevant to achieve established strategic objectives. Projects are required to be implemented in less time and with higher quality [4]. It is common for more than one project to be carried out at a time, representing a challenge in managing the scope, budget and schedule, which is why projects need to be implemented through clear methodologies that allow the project to be carried out without problems. [5].

The objective of this article is to present a methodological proposal for the comparison of existing methodologies that helps to identify and adapt the methodologies with which adequate monitoring of innovation projects in a technology company can be provided, that adapts to the needs of the company and are considered knowledge management

techniques and tools, and allows compliance with the dates and commitments established in the projects carried out and in turn increase the satisfaction of internal clients.

The structure of the document begins with the theoretical framework, where the most relevant concepts for carrying out this study are presented. The definition of the problem continues, in which the most important points are raised and which are sought to be resolved based on the methodology. Subsequently, the methodology to follow to solve the problem is shown. Following the implementation and the obtained results. Finally, conclusions are formulated based on what has been done.

II. PROBLEM

The project is carried out in the Innovation department of a technology services company for human resource administration, attendance control and correct payroll calculation and always in compliance with the law, located in two corporate offices in the cities of Tijuana and Hermosillo, and 18 branches across the Mexican territory. The department carries out its activities remotely, which is responsible for analyzing the needs of (internal) clients and managing improvement projects in the different departments of the organization.

It was detected that each employee in the innovation department determines the way they manage each project, because they typically work individually, leading to communication problems and confusion with the rest of the personal involved, causing dissatisfaction with the internal clients. Likewise, what is learned in projects is not usually shared openly, leading to rework on certain related projects.

In the development of projects, situations arise such as ignorance of the status of commitments and differences in expectations regarding the results of the project, not allowing adequate monitoring and closure of activities. On the other hand, there is a lack of traceability in the project development processes, therefore, if an employee of the department is absent or reassigned to another project, the process of monitoring the projects by another member becomes more complex, because there are no defined processes or spaces to share the knowledge acquired and the lessons learned; this leads to an increase in project analysis time.

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III. THEORETICAL FRAMEWORK

This section contains the topics and related studies that served as support for the development of this study.

A. *Project management*

Projects are a set of activities necessary to produce a defined result in a given date range and with an allocation of resources. Their temporal nature means that they have a beginning and an end [6]. It is non-repetitive work, which must be planned and carried out according to certain specifications [7]. Project management is the application of knowledge, skills, tools and techniques to project activities to guide the work performed within the project and meet project requirements [8]. It represents an accessible platform to optimize the operations of organizations within the criteria of costs, time and quality [9].

In research and technological development projects, staff frequently modify projects, especially in terms of deadlines. Another characteristic found in these types of projects is that they have a short timeline and a small budget, which can reduce the chances of generating short-term results. From the above, it is evident the importance of having the practice of project management, with the aim of obtaining improvement in productivity [10].

B. *Knowledge management*

Knowledge management refers to the process by which an organization generates, shares, distributes and, in general, manages information among its stakeholders in order to advance its process of wealth creation and value addition [11]. Knowledge is considered a fundamental asset for a project and is linked to the methodology and communication practices used in the projects themselves. Therefore, knowledge management is a tool for the successful completion of a project [3]. Having the “right knowledge” to the “right person(s)” at the “right time” allows for greater control over the project [12].

As a result of the processes or cycles analysis of different authors and the integration knowledge management cycle based on the main approaches that describe its key processes, three main stages were obtained: (1) knowledge capture or creation, (2) knowledge exchange and dissemination, and (3) knowledge acquisition and application [13].

In a study carried out by [14] it was found that all stages of the SECI Knowledge Management model (socialization, externalization, combination and internalization of knowledge) positively and significantly influence incremental innovation capabilities, which It is reflected in improvements within the products and services offered by the organization.

C. *Innovation*

The application of innovation is increasingly important to create and sustain an organization's competitive advantages, as well as promote its growth and prosperity [15]. It is considered a source of competitive advantage, is fundamental for improving the organization and can impact people, institutions,

entire economic sectors and countries in multiple ways [16]. Innovation is considered a source of competitive advantage in organizations [17], it is fundamental to improvement and can affect people, institutions, entire economic sectors and countries in multiple ways [16].

Innovation is the potential of a company to develop capabilities for the creation or improvement of products in a differentiated way that deliver superior value to customers and to the company itself. It is a necessary complement to direct the performance of companies. Therefore, innovation stands out as a strategic response so that companies adapt to constant changes and can continue to be competitive along with the improvement of products and processes in environments of continuous change [18].

D. *Organizational communication*

Organizational communication involves the combined use of internal and external communication, used in a conscious and harmonized manner to lay the foundation for building relationships with interested parties, thus giving credibility to messages [19]. In recent years, the need has arisen to find new ways to maintain contact in a remote working context, and internal communication has played an important role within organizations since the beginning of 2020, just as digitalization has given rise to new models of collaboration and work coordination [20].

Transferring knowledge requires communication and it is necessary to avoid barriers to transmit and store knowledge. Therefore, lessons learned are knowledge stored during all phases of the project, so if barriers exist, communication does not occur effectively and lessons learned are not shared correctly [21]. Project team members need to collaborate, share, collect, and integrate information and knowledge to achieve project objectives. Ill-defined tasks and critical processes, uncertainty regarding responsibilities, scopes or objectives can cause projects to fail [22].

E. *Technological tools*

Now a days, technology is a key factor in productivity, innovation and competitiveness. Technology can be a basic element of company differentiation [23]. Technological tools are defined as the systematized mechanism to obtain valid and accurate information on specific topics [24]. Through more efficient use of technology, the decision-making process is improved at all levels of the organization [25].

The use of the appropriate tools can be of great help when managing the project and improving communication between team members, providing solutions to different situations that may arise during the development of projects for coordination and communication throughout. throughout the project [26]. Due to the complexity of the project and its importance for any organization, special computer support is required for its implementation [27].

F. Related studies

The effect of knowledge management processes on innovation performance was explored in the study by [28]. It was hypothesized that different knowledge management processes exert a positive influence on innovation performance and that knowledge hoarding has a moderating effect between knowledge management processes and innovation performance. It was concluded that each knowledge management process in organizations exerts a significant positive effect on innovation performance and employees should be encouraged not to have a behavior of accumulating knowledge and that it is better to share knowledge to achieve good results for the organization. company.

In reference [10] it was developed a model for the development of projects that allows efficient management from innovation in technology, based on a literary review of standards and methodologies in the field of engineering and management, where its main characteristics were identified and an evaluation was carried out. comparative and then integrate different activities from the different standards and methodologies evaluated, resulting in the proposed model. To evaluate the effectiveness of the model, a practical case was carried out comparing a previous project (project B) with a new one (Project A), obtaining that project B exceeded 16% in time, while in the new project implemented with the new methodology, all established dates were met.

Comparisons were made to choose a methodology for project management in the study of [28], indicating its main characteristics based on a literary review, starting with a comparison between traditional methodologies and agile methodologies, followed by a comparison of the PMBOK, PRINCE2, SCRUM and KANBAN methodologies. It was identified that both traditional and agile methodologies have elements in common such as planning, changes in the project and participation of those involved, differing in the degree to which each methodology has it configured. It is indicated the importance of knowing different methodological options and choose based on the nature, size, objectives, scope and environment of the company. Likewise, it is proposed that it is increasingly common to carry out hybrid management, where the best practices of each methodology are compiled.

IV. METHODOLOGY

For the development of the methodological proposal, existing methodologies, previous studies and approaches to the main topics considered in this study were taken as a basis; considering the search and comparison of project management methodologies that can cover the needs presented in the problem, taking into account the notable characteristics of the methodologies classified as traditional and agile [28], as well as the relationship of project management with knowledge management as an important tool for the success of the project [3], and the study by [10] where an evaluation of alternatives to project management standards and methodologies was carried

out, presenting an ordered system with a view to generate innovation in products.

Fig. 1 presents the proposed methodology seeking to obtain the design of a solution for the adequate monitoring of the projects implemented by the innovation department of the technological services company, in which the fulfillment of the commitments and the increase of internal customer satisfaction.

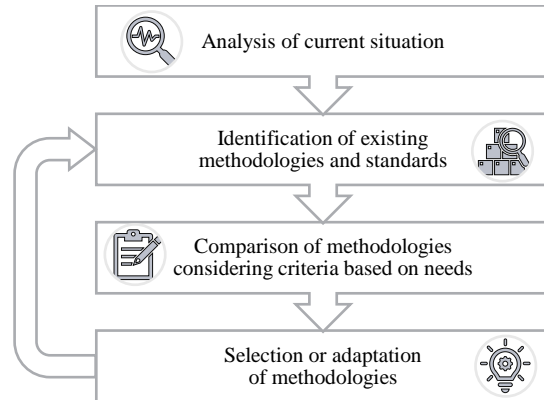


Fig. 1. Proposed methodology (own elaboration).

The detail of each phase presented in Fig. 1 is explained below:

1. Analysis of current situation.

The objective is to know the current situation of the area of interest regarding the process that is carried out for the implementation of its projects, detecting the positions and departments involved, as well as knowing the situation of the department regarding knowledge management. An approach is made to the general aspects of the department and an attempt is made to obtain information about the environment in which it operates. A questionnaire is proposed for the members of the department in order to obtain an initial diagnosis.

2. Identification of existing methodologies and standards.

In this phase the aim is to know existing methodologies for correct project management; Different existing project management methodologies are searched and analyzed and compiled based on initial search criteria based on the needs detected and problems initially raised, seeking to filter the existing results.

3. Comparison of methodologies considering criteria based on needs.

Initially, the criteria that will be considered are determined to make a comparison and select the methodology or methodologies that best adapt to the needs. It is important to indicate that it is possible to add or edit the criteria depending on the environment in which you seek to apply them.

Once the criteria for comparison have been defined, the comparison matrix of the project management methodologies is generated, which allows the main characteristics of the methodologies to be clearly seen and the advantages and

disadvantages are highlighted depending on the needs of the area of interest where the solution would be applied.

4. Selection or adaptation of methodologies

Once the existing methodologies have been compared, the methodology or methodologies that best adapt are chosen according to the criteria established in the comparative matrix. Based on the decision made, it is possible that a single methodology can be adapted to the needs of the area of interest, or it is necessary to adapt different points of methodologies that were compared so that a solution to the problem can be provided. It is important to consider the current situation of the area of interest to consider and include the points that benefit it the most. Having made the selection or adaptation of the methodologies, you can return to phase two if you need to add additional methodologies to carry out the comparison.

V. IMPLEMENTATION

Next, the implementation of the proposed methodology is explained in detail, indicating the activities and results obtained in each phase.

1. Analysis of current situation.

In this phase, information was collected regarding the process they currently have for carrying out the projects and the current situation of the department regarding knowledge management to obtain an initial diagnosis.

A survey was conducted among the members of the department through Google Forms, where questions were made regarding the current process for project implementation, the perception regarding this process, as well as comments for improvement. The following results were obtained:

- The role they have within the projects is to analyze and direct or manage the projects that are implemented with other departments. Likewise, the departments with which they regularly work on projects are “Support” and “IT”.
- Each member performs different steps, but certain similar steps can be identified among the responses, such as: initial session, need analysis, design of the proposed solution, validation, implementation, monitoring and closure.
- 66.7% of the surveys indicate that they consider that it is not easy to follow the steps they indicated, since they do not have an understanding or knowledge of the steps that should be implemented, as well as that there are usually changes in the projects and in turn there are usually different characteristics between Projects. The above highlights that each one implements the steps as they consider necessary.
- In general, the personnel surveyed added comments that highlight the need for a methodology that is adapted and established to be able to work correctly, including involving the

departments with which they work and deliverables.

For the diagnosis of knowledge management, a survey was carried out through Google Forms, where questions were asked based on a 5-point Likert scale, to detect the situation regarding identification, acquisition, creation, storage, transfer and dissemination, application and measurement of knowledge.

Fig. 2 shows the graph generated from the average of the survey results divided by knowledge management activity.

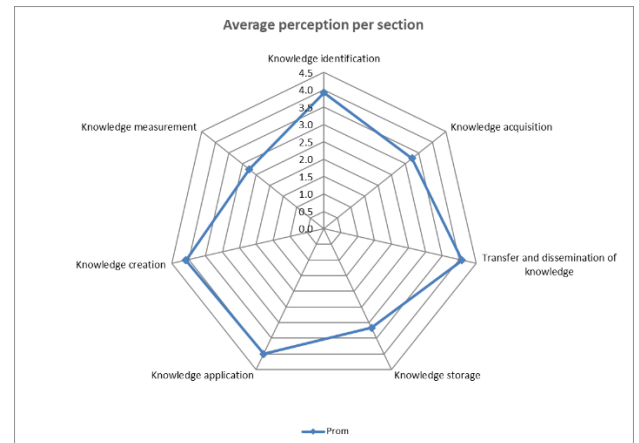


Fig. 2. Results of the initial diagnosis of knowledge management (own elaboration).

In the results it can be seen that the strongest areas of the department are the transfer and dissemination of knowledge and the creation of knowledge; while the main opportunity for improvement is found in the measurement of knowledge.

2. Identification of existing methodologies and standards.

In this phase, existing methodologies for project management that best adapt to the problem posed were researched and analyzed, considering the following defined search criteria: a defined project management methodology, have applications in topics related to innovation and in technology companies, recognize the importance of knowledge and its management during the project, consider it important to rely on technological tools and have previous successful cases demonstrating the benefits.

Based on the search results, the methodologies that were selected for comparison are PRINCE2, PMBOK, SCRUM, KANBAN and Lean Project Management.

3. Comparison of methodologies considering criteria based on needs.

In this phase, the comparison was made between the analyzed and selected methodologies, using the previously defined comparison criteria, as well as the way in which they would be measured.

Below, Table 1 presents the comparison matrix between the selected project management methodologies:

TABLE I
METHODOLOGY COMPARISON MATRIX

Methodology	Application areas	Size of projects supported	Type of methodology (agile/traditional)	Adaptability	Differentiator element	KM application/ importance of knowledge
PRINCE2	All	Over 2 months	Traditional	Different types of projects	7 principles to carry out the project	Yes
PMBOK	All	Over 2 months	Traditional	Different types of projects	Good practices to seek better control and monitoring	Yes
SCRUM	Mainly software/IT sector	0 to 6 months	Agile	Changes, Different types of projects	Use of "Sprints"	Yes
KANBAN	All	0 to 6 months	Agile	Changes, Different types of projects	Use of Kanban cards, Lean principles	Yes
Lean Project Management	Mainly manufacturing sector	Over 2 months	Agile	Different types of projects	Lean principles: maximum value with minimum waste	Yes

Adapted from [28] and [29].

4. Selection or adaptation of methodologies

Once the comparison of the methodologies was carried out, certain points were highlighted that would benefit project management in the area of interest because, based on the literature, it was found that the chosen methodologies can provide important aspects for the proposed methodology for the area of interest. Table 2 lists the methodologies and points to take into account:

TABLE II
SELECTION OF THE ASPECTS OF THE METHODOLOGIES TO CONSIDER

Methodology	Aspects to consider
PRINCE2	Use of business justification principles, learning from experience.
PMBOK	Identification of those involved, define objective and scope of the project (of the initiation processes).
SCRUM	Use of backlog, team self-organization, multidisciplinary team integration, collaboration with stakeholders, adaptability.
KANBAN	Visual task management, task status indicate what is being worked on.
Lean Project Management	Reduction of waste such as time spent in meetings, carrying out only the necessary documentation.

Once each aspect to apply is identified from each methodology, Table 3 presents greater detail of each aspect and how this would be considered in the activities to be carried out in the proposed methodology, so that there is greater clarity to apply the proposal.

TABLE III
PROPOSED ACTIVITIES FROM THE ASPECTS CONSIDERED

Methodology	Aspects	Justification	Activities
PRINCE2	Use of business justification principles, learning from experience.	Continued business justification. It ensures that there is a justifiable reason for starting the project and that it lasts throughout its life [30], [31].	Understand the needs and justification.
		Learn from experience. Previous experiences are collected, those obtained during the project and the lessons learned at its closure [30], [31].	Document the needed information to share knowledge.
PMBOK	Identification of those involved, define objective and scope of the project.	Included are those processes required to establish the scope of the project, establish the objectives and the way to proceed to achieve the established objectives [32].	Start: understand the problem, define objective, scope, participants.
		Processes required to identify the people affected by the project, analyzing the expectations of the stakeholders [31]	
SCRUM	Use of backlog, team self-organization, collaboration with stakeholders or clients, adaptability.	Backlog: List of work items identified by the team to be completed [33].	Obtain feedback from the client and adapt if necessary, prioritization of activities in the backlog.
		Requirements for project goals may change over the course of the project as new challenges arise [33].	
		Continuously consult with the client on progress, obtain feedback and adjust if necessary [34].	
KANBAN	Visual task management, task status, indicate what is being worked on.	Improvement in performance based on the transfer of information and operational experience [34].	Development: use of cards and progress of tasks (backlog, analysis, development, testing, implementation, completed).
		The adoption of techniques to generate new knowledge and self-management of customized teams is encouraged [34].	
		The Kanban board is a key tool to map and visualize a workflow. Each board is divided into sections that can be: to do, in progress or ready [33].	
Lean Project Management	Reduction of waste such as time spent in meetings, carrying out only the necessary documentation.	Through the Kanban board and the movement of the cards, it is possible to see the process flow [31].	Prioritize pending tasks or projects to start.
		The cards usually have various information: description, estimate, etc. Each task status changes as it progresses [31].	
		It focuses on communication, collaboration and integration between those involved [35].	
Lean Project Management	Reduction of waste such as time spent in meetings, carrying out only the necessary documentation.	Focus on activities that add value and avoid unnecessary ones [33].	Carry out only the necessary documentation.
		Sometimes participants may be spending more time in meetings than doing another activity that provides greater value to the client [32].	
Lean Project Management	Reduction of waste such as time spent in meetings, carrying out only the necessary documentation.	The documentation process requires effort that must be measured, not investing more time than necessary and ensuring that the necessary information is available [32].	Carry out only the necessary documentation.

VI. CONCLUSIONS

The present study proposes a methodology to carry out a comparison of project management methodologies and standards, seeking to detect the notable aspects that are beneficial for the adequate management of projects in an area of interest. Particularly, the approach of this methodological proposal considers the adaptation of project management methodologies based on the comparison of methodologies

classified as traditional and agile, as well as their relationship with knowledge management.

Both traditional and agile methodologies were included, to exploit the advantages of each one: properly stating the needs, objective and scope of the projects, among others for traditional and constant feedback from the client that provides the opportunity to deliver a better solution, use of backlog, among others for agile methodologies. It can be highlighted that both types of methodologies coincide in the importance of carrying out knowledge management activities such as carrying out the necessary documentation and sharing the lessons learned with the rest of the team, seeking to obtain better results and better use of time.

Future work would include a detailed description of the steps to follow and continue validating the proposal in more innovation projects within the technology company. This seeks to cover the needs and problems detected and specified in the problem. This methodological proposal can also be implemented in other similar organizations that wish to develop innovation projects, obviously, making the pertinent adjustments to suit their particular needs.

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