

Handbook of Research on

Project Management Strategies and Tools for Organizational Success



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Flor Nancy Diaz-Piraquive, and Rafael Ignacio Perez-Urbe**



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Sandra Marcela Delgado-Ortiz, Universidad EAN, Colombia

One of the factors that positively affect the objectives of a project is the performance level of the human talent that executes it. From the human point of view, a project can be defined as the action of a group of people focused towards achieving an outcome. This research work seeks to establish the general skills that a person who is part of a work high-performance team must have, that allow him or her to positively influence collective performance. A general skill describes the behavior and abilities of an individual, regardless of the degree of complexity that frames a job. This study was carried out with the support of 149 project managers from the Colombian software industry.

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Rubén González Crespo, Universidad Internacional de la Rioja, Spain

The purpose of this article is to expose the articulation that should exist between the CEO's competences of projects and TI's business processes with an effective management for the execution, follow up, control and closing of projects, making emphasis in the planning and management areas which are the ones that relieve the complexity as an intangible reality within the unstable environment of changes and competition in which companies or organizations move. An analysis of technological surveillance was done which explains the traceability and importance of the areas and their relationship with the timely and accurate decision making, as long as processes are taken into account such as strategic management, risk management, adequate administration of resources and time, as well as soft elements associated to leadership and emotional intelligence that the TI projects and processes' CEO should have. Under these circumstances, competences of CEOs are raised and how they manage the dynamic organizational scenarios.

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H. Mauricio Diez-Silva, Universidad EAN, Colombia

Maricela I. Montes-Guerra, Universidad de La Sabana, Colombia

Hugo Fernando Castro Silva, Universidad Pedagógica y Tecnológica de Colombia, Colombia

This article examines team conflict in project management. A study of the current literature, the focus of the bodies of knowledge and the perspective of managers in Colombia is presented. Information is collected through a questionnaire about the impact of sources, types of conflicts, dispute resolution mechanisms and progress reports on the final performance of projects carried out recently by the interviewees. The importance of conflict resolution has been validated as a success factor in the management and performance of projects. The chapter aims to increase researcher interest in the subject, as well as to encourage the development and implementation of methodological tools, in order to achieve better results in the implementation and success of projects.

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Dora Alba Ariza, Universidad EAN, Colombia

This chapter describes the findings of a research aimed to determine the cultural characteristics which have incidence on the management effectiveness of IT projects. A quantitative study was carried out. Confirmatory factor analysis (CFA) and structural equation modelling (SEM) were applied. A random sample of 139 respondents conformed by leaders and team members who developed IT projects in private companies from different economic sectors located in Bogotá, Colombia was used. The evidence shows that the adaptation to solve problems has incidence in the management effectiveness of IT projects and the compliance of stakeholder expectations can be predicted from the alignment level of the projects with the strategy and the consideration of their needs and opinions. The study extends the theory in project management and information technology. The results can guide the efforts of project offices to identify cultural characteristics which can be intervened to enhance the project success.

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Jaime Hernando Malagon-Barinas, EAN University, Colombia

This chapter describes and details the P3S-VB model: the Selection of Projects and Programs Portfolio Based on Value. The P3S-VB contributes to the discipline of project management and portfolios, in the definition of the constructs of an appropriate level of incorporation of capabilities, value and technology; identification of the range in which technological capabilities, projects and portfolios can create value; the processes for selecting the portfolio of projects based on value; and the alignment of benefit management and project management. The model was designed keeping the rigor of scientific research, following as a reference the DSR-IS science design method, with a focus on practical applicability.

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Early research on organizational change emphasizes the importance of change management. They offer a range of managerial practices that allow the organization to carry out its changes, which is more in line with a planned process. Such an approach overlooks the fact that organizational change can be explained by other processes such as the political process, the interpretative process, the incremental process and the complex process. Each of these processes offers particular characteristics of change. The observed change was marked by the different characteristics falling within the various explanatory processes of change. Results differ according to the context in which change evolved. Through this paper we seek to understand and explain the results related to the existence of different characteristics that are part of the different explanatory change processes (political, interpretative, incremental and complex processes) in a change planned by the senior management of a company.

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César Hernando Rincón-González, Universidad EAN, Colombia

Flor Nancy Díaz-Piraquive, Universidad Catolica de Colombia, Colombia

This applied research work identifies the impact of the project management offices (PMO) on knowledge management among 502 organizations from Colombian enterprises. First, a literature review about PMOs and knowledge management within the project perspective was conducted. Then, a bibliometric analysis was conducted in order to establish the link between this type of offices and the knowledge management on scientific publications about project management. Afterwards, a comprehensive theoretical framework about the matter of study was build. Subsequently, an information gathering instrument was developed in order to collect data for the research. Next, a nation-wide fieldwork was undertaken by analyzing the organizations. Successively, a detailed statistical analysis was conducted in order to identify the impact of the project management offices on knowledge management within the objects of study. Finally, results and conclusions were documented, and future lines of research were established.

Chapter 8

Competence Training for Project Management: Holistic Analysis Framework 196

Sara Marcelino-Sádaba, Public University of Navarre, Spain

Amaya Perez-Ezcurdia, Public University of Navarre, Spain

Organizations currently need project managers that are capable of performing in environments where change has gained great relevance. To accomplish this, these professionals must possess very diverse skills. On the other hand, project management is a young discipline that requires research to help us understand how to develop these skills. This chapter provides a holistic research framework proposal that is based on four elements: competences, approaches, scenarios, and levels of analysis. We affirm the importance of the meta-cognition competency, which is not commonly mentioned in previous studies but has proven to be very useful for a professional development that is self-regulated, reflective, and experience-based, with emphasis on the opportunities offered by new technologies. Two fundamental challenges are introduced: achieving a list of unified competences and transferring individual competences to the project teams and the organizations where these competences are displayed.

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Risk Management in Small Hydroelectric Power Plants (SHPPs) in Colombia 223

Gustavo Alberto Villamarin, Universidad del Rosario, Colombia

Flor Nancy Díaz-Piraquive, Universidad Catolica de Colombia, Colombia

Although Colombia has more than 50 years of experience developing hydropower projects, the recent Hidroituango project crisis has opened the debate regarding risk management (RM) in generation power projects, especially for non-conventional renewable energy sources (NCRES) where there are no academic studies for Colombian case. This chapter develops a methodological proposal based on PMBOK, ISO standard, and Colombian technical standards, that will allow identification, assessment, and management of the risks inherent in small hydroelectric power plant (SHPP) projects. All this in the context of the opportunities generated by Law 1715 of 2014 and the mega global trend of transition from fossil sources of energy to NCRES. The methodology was built based on: a state of the art review, an expert's knowledge consultation, and a Delphi expert's assessment analysis. The result is a project risk management methodology that includes: holistic identification of risk variables in SHPP projects, assessment of experts and response to inherent and residual risks.

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Project-Based Organizations: Project Manager Challenges at the Interface With the Customer 247

Gustavo Birollo, Université Laval, Canada

William Stive Fajardo-Moreno, Universidad EAN, Colombia

Project-based organizations coordinate their activities using projects. These projects act as temporary and almost independent organizations that directly interlace the project-based organization with their customers. This complex interface is characterized by the existence of divergent interests between the two organizations. Therefore, project managers become crucial agents to handle this interface in order to accomplish the project's goals. By analyzing the retrospective accounts of twenty-four project managers, this chapter found that the project managers' actions that fostered the establishment of a relationship of trust and collaboration with their customer can be divided into four dimensions: providing knowledge, contextualizing the project, keeping the information flow, and boundary spanning. The authors argue that these project managers' actions and the generation of interaction spaces with the customer have an important impact on the development and success of the project.

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Towards a Multidimensional Explanatory Approach to Voluntary Organizational Change 269

Amira Sghari, Laboratory PRISME (LR18ES24), Faculty of Economics and Management,

University of Sfax, Tunisia

At the theoretical level, several authors have modeled the progression of change, which has given rise to several explanatory processes of change (planned, political, interpretative, incremental, complex processes, etc.). Each process has particular change characteristics. The empirical results showed the coexistence and complementarity of several explanatory processes of change to explain the change observed in the projects planned by the senior management. In this descriptive chapter, we present a synthesis of the different characteristics of the explanatory processes of change as well as the empirical results of their confrontation in the field. The purpose of this chapter is to highlight the importance of the different characteristics of change that shift up over time. A consideration of this aspect will allow managers to better target the managerial actions to be implemented throughout the change process in order to succeed it.

Chapter 12

Sustainability on Project Management: An Analysis of the Construction Industry in Colombia 281

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Ensuring the conservation of current resources for future generations has become a challenge that from day to day turns to be more important and urgent for society. Despite the fact that sustainability and project management have been subjects of interest in the academic community, few investigations are related to the integration of sustainability within project management, even fewer in the Colombian context. This empirical research work presents results about the perception from a representative sample of project managers from the construction industry in Colombia related to the implementation of elements of sustainability when managing projects established in the maturity model of Salem Azahrani. The results indicate, on one hand, a low average level of maturity and on the other, a higher orientation toward aspects of the economical dimension of the projects in comparison with the social and environmental dimensions.

Chapter 13

Model Based on Ontological Engineering as Support for Stakeholder Management 305

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Flor Nancy Díaz-Piraquive, Universidad Católica de Colombia, Colombia

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The objective of this article is a way of working that is used as an instrument for managing the parts with semantic and conceptual elements, such as mastery of management projects, and the effects of ontological engineering techniques, which solves frequently asked questions with respect to information related to this resource. This is done in an agile, precise, and effective way, facilitating its management in the phases that make up the life cycle of the project. The research will contribute to the integration of ontological engineering and project management, enabling the construction of a stakeholder information structure with semantic components that enable it to be the input of a more complex knowledge management model.

Chapter 14

Adopting Communications Management Practices in Project Management: A Preliminary Study

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Lenin Valencia Anduquía, Universidad EAN, Colombia

H. Mauricio Díez-Silva, Universidad EAN, Colombia

This chapter deals with the adoption of communication management practices applied by project managers in Colombia. It has become a priority in project management practices in the past decade, but the research field and knowledge domain has seen limited empirical evidence. Therefore, it verifies the influence of the application of these types of practices against performance indicators obtained in projects. To carry out this preliminary study, leaders of companies from different sectors of Bogotá in Colombia were interviewed under a mixed-methods approach. It was verified that the practices currently applied have a low adoption rate, but they are influential for achieving success in project management and highlight the importance of these types of techniques for the performance of the planned work. This study aims to generate the option of applying unconventional approaches to manage communication in projects that allow for improving performance rates in companies.

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Gonzalo Andres Rodríguez Cañas, Universidad EAN, Colombia

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The complexity of projects of international cooperation (IC) and especially the characteristics which are similar to those of social, international projects in the public sector, and the amount and diversity of the interested parts, makes it necessary to implement strategies when handling conflicts in order to maintain the project according to the established plan and get benefits based on its objectives. This empirical cross-cutting research has as main objective to identify the conflict management process in project teams of international cooperation in Colombia and determine the great influence observed in the style of handling the conflict on the performance of the project. The results showed that the cooperative and collaborative styles are significantly and positively related to the project performance whereas competitive and evasive styles affect significantly and negatively the performance of the project of international cooperation in Colombia.

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Soft Skills as a Critical Success Factor in Project Management	376

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Project management is a field of knowledge that presented a notable development as a means of impact on organizational competitiveness. About 30 years ago, this field was considered as a series of tools that contributed in some aspects of improvement in organizations. Over time, these tools were transformed into theory and in the same way their development at the scientific level increased. Now, project management is recognized as the means through which the strategic plans in the companies are managed. Therefore, they form the bridge of business sustainability. Among the different developments that have been made in the project management is the establishment of critical success factors. The current literature offers various approaches. One of the research trends as a critical success factor that is proposed in the future is the identification and measurement of the soft skills of the project manager. This is how this chapter of the book will address the identification and analysis of soft skills.

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The purpose of this document is to present the evolution of the supply chain with different points of view, from the perspective of the main authors on the subject, in order to show the benefits and difficulties faced in carrying out the sustainable orientation of the supply chain (SSCO). For this research, it is necessary to take into account from which point each of the definitions that helped reach the concept of SSCO was born and how the concept has changed over the years. It is interesting to note that currently the concept does not have a specific definition, because it is in a boom in recent years, which makes it

an attractive topic to investigate and learn more in depth. In Colombia it has very few exponents of the subject. Therefore, researching SSCO can generate a competitive advantage in the industry for supply chains that compete in the interior and exterior of the country.

Chapter 18

Communication for Cultural Project Teams: How to Use Digital Tools 411

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Mexico*

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The projects developed by cultural companies represent important challenges in communication, which were identified through an exploratory study with a mixed approach applied in the Puebla, Mexico area. In this study, 21 cultural organizations were identified, which were categorized into three levels depending on the maturity of their business processes. They inquired about how they are using digital tools in cultural projects. They identified the use in internal communication, the use in external communication, and the control phase in projects. The results show that although some projects are already using digital tools, they should still work on the implementation of strategies that improve the effectiveness of the results of cultural projects.

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Principles of the Management of Projects Applied to the Development of Neighborhood Stores..... 428

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Laura Marcela Patiño G., Universidad EAN, Colombia

This chapter describes the specific characteristics of neighborhood stores; for this purpose, a brief summary of the historical conditions in which they have developed, their evolution, characteristics, and the conditions that make them different from other formats of retailer commerce is presented. Taking into account that this is a business model that raises from the base of the pyramid and is developed in the provision of services in a high percentage, it raises some basic concepts of this model that are applicable to the neighborhood store. On the other hand, the authors look forward to bring together the basic concepts of project management to the store from two perspectives, the first from programs that may or may not be from the government, that bring support in the search for its consolidation as a socially and economically sustainable model, and the second from the own management of the store, which due to the lack of fundamental knowledge on administration from the owner, seems to be condemned to its survival, without major possibilities of growth.

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Universidad EAN Breaking a Babel Tower Applying SAP as a Tool Under a PMO Model 443

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This chapter describes the PMO model used to renovates the information systems of the Universidad EAN that before 2015 operated with multiple obsolete tools, generating incidents in the management of the information required for its operation. As part of the institutional innovation project implemented to ensure economic and administrative efficiency besides its strategic alignment, a SAP-based solution

was implemented allowing it to move from a technological babel tower with almost 40 independent information systems in multiple platforms, towards a comprehensive platform that ensured a unified interoperability model with a scalable hardware infrastructure, using state-of-the-art applications supporting the provision of self-services to the community, expanding IT capabilities, reducing the risks, increasing the information security, improving the quality of service, and, despite being it in a stabilization stage, has been supporting the operation in an efficient and effective way, as shows the institutional results from the financial and academic quality perspectives.

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Preface

Project management has long been discussed by corporate executives and academics as one of several workable possibilities for organizational forms of the future that could integrate complex efforts and reduce bureaucracy. . . . This approach does not really destroy the vertical, bureaucratic flow of work but simply requires that line organizations talk to the other horizontally so work will be accomplished more smoothly throughout the organization, (Kerzner, 2009)

Currently, project management occupies an important place in management approaches, due to its orientation to achieve concrete results of a correct administration of time and resources. The global economic field is characterized by constant change in markets, the need for clear and compelling results, and the design of differentiation strategies. This has led companies to search for management tools that allow them to take advantage of the opportunities offered by the environment in general.

The objective of this publication is the compilation and dissemination of new trends in project management, through the contribution of research experts in the different topics that make up this discipline.

The chapters included in this publication provide research results, both theoretical and practical, on the different topics of project management. The topics presented in this work will be the analysis of trends and best practices in project management. We want to give the reader a different point of view about project management and how this discipline can support the achievement of the objectives of an organization.

The different topics covered by project management are transversal to any organization. Analyze and disseminate new trends in this discipline will allow managers to improve their skills and strengthen the performance of their companies, through obtaining better results in the projects undertaken. Likewise, in the academic field, it is essential to be clear about the evolution of project management in different business contexts.

The target audience of this book are academics, professionals in project management, business managers and professionals from any area. The book will be a useful tool for academic institutions, undergraduate and graduate students in business and engineering areas.

THE IMPORTANCE OF PROJECT MANAGEMENT

The discipline of project management has changed a lot compared to past times. Nowadays, the project manager must focus his management on trying to generate value for companies, not only should he devote himself to controlling the variables that make up the triple constraint: scope, time and costs. The project manager must be an excellent resource manager and have the ability to understand the organizational strategy. Projects must emerge as a response to the strategies proposed. Action plans come true thanks to the projects (Kerzner, 2009).

The Project Management Institute (2017) defines the direction of projects as the application of knowledge, skills, tools and techniques to project activities to meet their requirements. From this definition, we can identify four competencies that track the behavior of the project manager: he must be a person with leadership, capable of making good decisions, focused on results and with a great technical skill that allows him to work under pressure.

Likewise, three variables that characterize the project manager are proposed:

- **Knowledge:** Refers to what the project manager knows about project management.
- **Performance:** Refers to what the project manager can do or achieve if he applies knowledge in project management.
- **Personnel:** Refers to the way in which the project manager behaves when executing the project or related activities. Personal capacity encompasses attitudes, basic personality characteristics and leadership (the ability to guide the project team while meeting the project's objectives and balancing the project's restrictions).

From a technical - disciplinary point, project management can be understood as a structured process that contemplates the stages of initiation, planning, execution, monitoring and control in a sequential manner, which should lead to obtaining the objective for which the project was created (Babatunde & Muritala, 2011).

The phenomenon of globalization has caused organizations to be constantly changing and leaders persist in incorporating new ways of generating value to their customers, giving greater relevance to the use of project management methodologies, which consider a growing trend in the near future (Charvat, 2012).

The project management discipline was characterized by being discontinuous, complex and innovative in nature, affecting companies in the medium and long term, through the action of the motivating forces of the project such as the scope of results and the achievement of resources. In the case of strategic projects, the projects constitute an excellent tool for obtaining the objectives set (Pinto, 2000).

Ahlemann, Teuteberg, and Vogelsang (2009) define project management as a discipline focused on organizing and managing resources, in order to achieve the objectives set within triple constraint: scope, time and cost. Project management involves executing a series of previously planned activities, which consume resources such as time, money, equipment and materials. Likewise, the participation of human talent becomes essential for achieving the expected results.

Achieving the objectives set out in a project requires distinguishing between the urgent and the important, detecting what activities or tasks have a higher priority than others do, and applying that meaning in each interaction with the work team. This can be considered as the implementation of the concept of project management (Blasco, 2000).

In the project management discipline, the identification of project restrictions has become a very important task, so priority is achieved, determining which are the negotiation spaces, this allows the project manager to know the variables of the triple restriction that should increase or decrease. Thus revitalizing decision-making, reducing the probability of obtaining the objective for which the project was create.

BOOK ORGANIZATION

This book is organized into 20 chapters. A succinct description of each of the chapters follows:

- **Chapter 1:** One of the factors that positively affect the objectives of a project is the performance level of the human talent that executes it. From the human point of view, a project can be defined as the action of a group of people focused towards achieving an outcome. This research work seeks to establish the general skills that a person who is part of a high performance work team must have, that allow him or her to positively influence collective performance.
- **Chapter 2:** The purpose of this article is to expose the articulation that should exist between the CEO's competences of projects and TI's business processes with an effective management for the execution, follow up, control and closing of projects, making emphasis in the planning and management areas which are the ones that relieve the complexity as an intangible reality within the unstable environment of changes and competition in which companies or organizations move.
- **Chapter 3:** This article examines the conflict of the work team in project management. A study of the current literature, the focus of the bodies of knowledge and the perspective of managers in Colombia is presented. The importance of conflict resolution has been validated as a success factor in the management and performance of projects.
- **Chapter 4:** This chapter describes the findings of a research aimed to determine the cultural characteristics which have incidence on the management effectiveness of IT projects. The findings evidenced that the adaptation to solve problems has incidence in the management effectiveness of IT projects and the compliance of stakeholder expectations can be predicted from the alignment level of the projects with the strategy and the consideration of their needs and opinions.
- **Chapter 5:** This chapter describes and details P3S-VB model: Selection of Projects and Programs Portfolio Based on Value. The P3S-VB contributes to the discipline of project management and portfolio, in the definition of the constructs of appropriate level of incorporation of capabilities, value and technology; identification of the range in which technological capabilities, projects and portfolios can create value; the processes for selecting the portfolio of projects based on value; and the alignment of benefit management and project management.
- **Chapter 6:** Early research on organizational change emphasizes the importance of change management. They offer a range of managerial practices that allow the organization to carry out its changes, which is more in line with a planned process. Such an approach overlooks the fact that organizational change can be explained by other processes such as the political process, the interpretative process, the incremental process and the complex process. Each of these processes offers particular characteristics of change. The observed change was marked by the different characteristics falling within the various explanatory processes of change.
- **Chapter 7:** This applied research work, identified the impact of the project management offices (PMO) on knowledge management among 502 organizations from the Colombian enterprise

context. Firstly, a literature review about PMOs and knowledge management within the project perspective was conducted. Then, a bibliometric analysis was conducted in order to establish the link between this type of offices and the knowledge management on scientific publications about project management. Afterwards, a comprehensive theoretical framework about the matter of study was build.

- **Chapter 8:** Organizations currently need project managers that are capable of performing in environments where change has gained great relevance. To accomplish this, these professionals must possess very diverse skills. On the other hand, project management is a young discipline that requires research to help us understand how to develop these skills. This chapter provides a holistic research framework proposal that is based on four elements: competences, approaches, scenarios and levels of analysis.
- **Chapter 9:** Although Colombia has more than 50 years of experience developing hydropower projects, recent Hidroituango project crisis, has opened the debate regarding Risk Management (RM) in generation power projects, especially for Non-Conventional Renewable Energy Sources (NCRES) where there are no academics studies for Colombian case. This chapter develops a methodological proposal based on PMBOK, ISO standard and Colombian Technical Standards, that will allow to identify, assess and manage the risks inherent in Small Hydroelectric Power Plant (SHPP) projects. All this in the context of the opportunities generated by Law 1715 of 2014 and the mega global trend of transition from fossil sources of energy to NCRES.
- **Chapter 10:** Project-based organizations coordinate their activities using projects. These projects act as temporary and almost independent organizations that directly interlace the project-based organization with their customers. This complex interface is characterized by the existence of divergent interests between the two organizations. Therefore, project managers become crucial agents to handle this interface in order to accomplish the project's goals. By analyzing the retrospective accounts of twenty-four project managers, this chapter found that the project managers' actions that fostered the establishment of a relationship of trust and collaboration with their customer can be divided into four dimensions: providing knowledge, contextualizing the project, keeping the information flow, and boundary spanning.
- **Chapter 11:** At the theoretical level, several authors have modeled the progression of change, which has given rise to several explanatory processes of change (planned, political, interpretative, incremental, complex processes, etc.). Each process has particular change characteristics. The empirical results showed the coexistence and complementarity of several explanatory processes of change to explain the change observed in the projects planned by the senior management. In this descriptive chapter, we present a synthesis of the different characteristics of the explanatory processes of change as well as the empirical results of their confrontation in the field.
- **Chapter 12:** Ensuring the conservation of current resources for future generations has become a challenge that from day to day turns to be more important and urgent for society. Despite the fact that sustainability and project management have been subjects of interest in the academic community, few investigations are related to the integration of sustainability within project management, even fewer in the Colombian context.
- **Chapter 13:** The objective of this article is a way of working that is used as an instrument for managing the parts with semantic and conceptual elements, such as mastery of management projects, the effects of ontological engineering techniques, which allows solving frequently, asked

questions with respect to information related to this resource. In an agile, precise and effective way, facilitating its management in the phases that make up the life cycle of the project.

- **Chapter 14:** This research paper deals with the adoption of communication management practices applied by project managers in Colombia. It has become a priority in project management practices in the past decade but the research field and knowledge domain has seen limited empirical evidence. Therefore, it verifies the influence of the application of these types of practices against performance indicators obtained in projects.
- **Chapter 15:** The complexity of projects of International Cooperation (IC)) and especially the characteristics which are similar to those of social, international projects in the public sector, and the amount and diversity of the interested parts, makes it necessary to implement strategies when handling conflicts in order to maintain the project according to the established plan and get benefits based on its objectives. This empirical crosscutting research has as main objective to identify the conflict management process in project teams of International Cooperation in Colombia and determine the great influence observed in the style of handling the conflict on the performance of the project.
- **Chapter 16:** Project Management as a field of knowledge that presented a notable development as a means of impact on organizational competitiveness. About 30 years ago, this field was considered as a series of tools that contributed in some aspects of improvement in organizations. Over time these tools were transformed into theory and in the same way their development at the scientific level increased, nowadays Project Management is recognized as the means through which the strategic plans in the companies are managed, therefore, they form the bridge of business sustainability.
- **Chapter 17:** The purpose of this document is to present the evolution of the supply chain with different points of view, from the perspective of the main authors on the subject, in order to show the benefits and difficulties faced in carrying out the sustainable orientation of the supply chain (SSCO). For this research, it is necessary to take into account from which point each of the definitions that helped reach the concept of SSCO was born and how the concept has changed over the years.
- **Chapter 18:** The projects developed by cultural companies represent important challenges in communication, which were identified through an exploratory study with a mixed approach applied in the Puebla, Mexico area. In this study, 21 cultural organizations were identified, which were categorized into three levels depending on the maturity of their business processes.
- **Chapter 19:** This chapter describes the specific characteristics of neighborhood stores; for this purpose, a brief summary of the historical conditions in which they have developed, their evolution, characteristics, and the conditions that make them different from other formats of retailer commerce is presented. Taking into account that this is a business model that raises from the base of the pyramid and is developed in the provision of services in a high percentage, it raises some basic concepts of this model that are applicable to the neighborhood store.
- **Chapter 20:** This chapter describes the PMO model used to renovate the Information Systems of the Universidad EAN that before 2015 operated with multiple obsolete tools, generating incidents in the management of the information required for its operation. As part of the institutional innovation Project implemented to ensure economic and administrative efficiency besides its strategic alignment, a SAP-based solution was implemented allowing it to move from a technological babel tower with almost 40 independent Information Systems in multiple platforms.

Finally, from the philosophy of free and useful knowledge, expressed in every way by the Research Group in Project Management and Management of the EAN University, this work was expected to contribute significantly to the strengthening of the good practices of the management discipline of projects and administration.

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Chapter 1

Project Management With High-Performance Work Teams: Analysis of Generic Competencies That Influence Collective Performance

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ABSTRACT

One of the factors that positively affect the objectives of a project is the performance level of the human talent that executes it. From the human point of view, a project can be defined as the action of a group of people focused towards achieving an outcome. This research work seeks to establish the general skills that a person who is part of a work high-performance team must have, that allow him or her to positively influence collective performance. A general skill describes the behavior and abilities of an individual, regardless of the degree of complexity that frames a job. This study was carried out with the support of 149 project managers from the Colombian software industry.

INTRODUCTION

One of the factors that most strongly affect the success of a project is undoubtedly the quality of the human talent executing it. Selecting the right staff to form the project team is an essential factor in meeting the objectives that have been set (Charvat, 2003). Within the framework of the knowledge society, the formation of high-performance teams has become one of the most important challenges that have had

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to be assumed in the processes of organizational development (Uribe, Molina, Contreras, Barbosa, & Espinosa, 2013).

From the human point of view, a project can be defined as the action of a group of people focused towards achieving an outcome. This action leads to a solution in the form of product or service (Estay-Niculcar, 2007). Projects in today's business environments not only consider solutions to technical problems, but also a way to improve business, implement changes, and enhance business strategies (Kerzner, 2017).

For Gómez and Arboleda (2008), there is a marked difference between work groups and work teams. In the first instance, they define work group as a group of people gathered by a formal authority to transform resources. For their part, the members of a work team have complementary skills, common specific objectives, under a clear and formal work plan. On the other hand, Rincon and Zambrano (2008) define a work team as the union of two or more people to fulfill a specific job, which requires the effort, knowledge and participation of each of its members.

Work teams are formal groups that the organizations establish in order to facilitate problem solving and decision-making. The performance of the work teams depends to a large extent on the environment in which they are developed; it is also essential for their members to be in constant communication and to receive the necessary training conducive to solve the problems that are related to their actions (Espinoza & Zarazúa, 2000).

Alcover and Gil (1998) emphasize in their research that the main objective of forming a work team structure is to achieve greater efficiency in carrying out the various activities that may be planned, since these types of productive units prove to be more efficient in coping to the challenges of today's environment.

McMillan (2001) exalts the importance of willingness and cooperation among team members with respect to developing their work. It also describes six elements that characterize a high-performance team:

- Common purpose: a work team has the potential to achieve exceptional performance when each of its members is identified with a common goal and is committed to its scope.
- Clear Roles: a high-performance team clearly defines the roles that each of its members will play; this will allow designing, dividing, and deploying the work that has been planned. Collective efforts are the key to achieving synergistic results.
- Accepted Leadership: high-performance teams need clear and competent leadership. The incompetence of the manager is the worst enemy of a project.
- Effective processes: a high-performance work team must have clear action processes that allow them to achieve the goal that has been set.
- Strong relationships: the diversity of skills, experience, and knowledge of the team members makes the levels of friendship to be limited.
- Excellent communication: fast and decisive decision-making is a priority factor when competing. The structure by work teams allows improving the capacity of response, as long as there is a permanent communication between its members.

Espinoza and Zarazúa (2000) present seven characteristics that distinguish high performance teams: (1) commitment of the members towards shared goals and objectives. (2) Decision making by consensus. (3) Open and honest communication among team members. (4) Shared leadership. (5) Climate of coop-

eration, collaboration, trust, and support. (6) Valuation of people by their diversity, and (7) Recognition and positive resolution of the conflict.

On his part, Miranda (2004) explains the importance of a correct description of the profiles that are required for the project team, as well as the necessity to clarify the procedures for recruitment, selection, hiring, and training of staff. He also highlights the “incompetent manager” as the worst enemy of a project, accentuating the interpersonal skills of the project manager in addition to its academic training and experience as a key factor for success, namely leadership, team building ability, motivation, communication skills, influence, decision making, politics and social awareness, as well as talent for negotiation.

For González (2011), leadership is a commitment. A leader becomes a guide, who provides orientation, directs, does not underestimate or subordinate his team. Moreover, it recognizes that everyone can be a leader in different situations. In order to develop a high performance team, a leader must take into account six basic principles: (1) vision, thinking big and outside the box; (2) reality, keeping achievable goals, not daydreams; (3) ethics, providing an effective and dignified service; (4) value, proceeding with initiative; (5) emotional intelligence, self-awareness, and self-criticism; (6) passion, optimism, and personal commitment.

Nowadays, shared leadership has acquired special relevance in the performance of work teams. It involves the distribution of leadership roles among different team members, rather than being concentrated in a single formal leader. This steering scheme generates a positive influence on the performance of team members (Carson, Tesluk, & Marrone, 2007).

As for the ideal size of the work teams, it should be clear that the more people conforming it, the greater the amount of available resources, however, it would also increase the complexity in the processes of coordination and control (Rico, Alcover, & Tabernero, 2010). It can be said that teams made up of three to six members are significantly more productive and more developed than those composed by seven or more people. This seems to indicate that small teams are more effective and oriented than large teams (Wheelan, 2009).

Another important aspect is the stability of the work teams. Making substantial changes in the number of members that make up the team can have a negative impact on its performance. However, if done on a smaller scale, in a gradual manner, the performance can be maintained or even improved (Perreti & Negro, 2007). Similarly, diversity in teams improves decision-making and creative problem solving. It is important to oxygenate the teams with new ideas and new points of view (Tjosvold, Hui, Ding, & Hu, 2003).

Hackman (1998) has identified five common errors that are committed upon when structuring work teams: (1) Not dismantling the organizational structures prior to the implementation of the teams so that they have sufficient power to carry out their work. (2) Failing to achieve a balance in the management of authority. (3) Not making a real restructuring of the work, continuing with a management that is centered on the individuals. (4) Establishing challenging team objectives without providing the necessary organizational support. (5) Assume that team members already possess the knowledge and skills that are necessary to work properly in a group.

One of the great mistakes at the moment of forming a work team is the desire to impose a permanent line of management control and authority. With a view to develop an efficient teamwork, it is necessary to give free room to its members and empower them, generating a commitment that is framed within the knowledge, motivation, and experience of each person (Blanchard, Randolph, & Grazier, 2006).

The success of a team is based on the ability of the top management to generate opportunities and resources to achieve the goals that have been set, for which the team has been formed. In addition, senior

management must give the team sufficient flexibility, so they are able to resolve and develop their challenges and commitments. High-performance teams must develop the appropriate mix of skills in order to perform the work to which they have committed to (Katzenbach & Smith, 2004).

Thus, this research work aims at establishing what the generic competencies that a person who is part of a high-performance work team must have, positively affecting collective performance. It is important to emphasize that a generic competence is one that describes the behavior and abilities of an individual; independent of the degree of complexity that frames a project.

THEORETICAL BASIS AND FORMULATION OF RESEARCH HYPOTHESES

From the authors that were consulted, one can say that work teams are constructed in an efficient structure of organization. Likewise, its degree of development depends to a large extent on the integration of its members towards a common goal. It is essential to form multidisciplinary teams where each of its members contributes its skills and experience to achieve the best results. In the discipline of project management, defined as a temporary effort with a specific objective, it is essential to rely on high performance project teams focused on achieving success, based on the integration of personal and technical skills. High-performance project teams are the guarantors to achieve the goals that have been set. If human talent fails, the objectives of the project will be compromised.

The experience, academic training, and commitment of its members characterize a high-performance project team. In like manner, the size of the group, the time of permanence in the team, and its self-management capacity, are key factors for the correct evolution of the outlined planning and objectives.

On the other hand, a competence can be defined as the ability of a person to perform effectively in a context that is often complex. It is based on the integration and activation of knowledge, abilities, skills, attitudes, and values. Knowing how to be and knowing how to do (Attewell, 2009).

In that order of ideas, and based on the bibliographical review, there are five generic competences identified as mandatory to be developed by the members of the project teams, so that it is cataloged of high performance: commitment, self-management, teamwork, analytical capacity, and systemic thinking. Each of the identified variables is described below:

Commitment of the Members

The commitment can be defined as the passion that the members of the project team demonstrate before the objectives that are set. The commitment is directly related to the person's motivation, and depends on how the environment can meet individual expectations. As motivation becomes stronger at a personal level, the bonds of group interaction narrow. The greater the motivation, the stronger the commitment, and the greater the synergy among the members of the work teams. Amidst the main motivators, the opportunity for achievement, growth, personal development, and recognition can be mentioned (Herzberg, 2008).

For his part, McClelland (1987) identifies three basic needs that frame individual expectations from which a leader manages to strengthen commitment in the work teams. In the first instance, one will find the need for achievement, the desire to excel, to succeed, and achieve the goals that have been set. In the second place, there is the need for power, which is intended to influence the behavior of others. Finally, there is the need for affiliation, to be accepted by a group or a specific person.

For McMillan (2001) one of the variables that most strongly influences the performance of the work teams is to share a common objective, which, insofar as it is clear enough, it will be easier to obtain exceptional results. Commitment increases when there is a common goal to work on. It is from these reflections that the first hypothesis of investigation arises:

Hypothesis 1. Strengthening the commitment of the project team members positively influence collective performance.

Self-Management

In the society of knowledge, the challenge that work teams have to face goes far beyond overcoming the circumstances that come with day-to-day projects, the key is how the individual manages to self-administrate his actions, focusing on the results that when added to those of other team members, constitute a significant achievement that is part of a common goal. Knowing how to prioritize activities, deliverables, time, and resources allows releasing stress and impact people's productivity in a positive way (Allen, 2015).

Self-management can be defined as the way in which a person can guide its actions with autonomy, in order to achieve a previously defined objective. People should be aware of their values and strengths, clearly identifying what they can bring to a team, and how performance can be improved. Personal productivity depends on how the individual assumes the responsibility of his work, from processes of innovation and continuous learning, thus ensuring the quality of results. Each member of a task force must be aware of what activities are to be developed and the results that are expected from them (Drucker, 2008).

Engaging team members with a challenging and exciting objective will facilitate the monitoring and control processes of the leader, allowing better results, optimizing the use of resources. A committed team works harder to achieve a collective vision, considerably reducing the follow-up to tasks and increasing the degree of trust between people. A visionary leadership style brings out the best of the work groups and their members. The permanence of its members becomes a decisive factor improving the synergy between the members of the team. In learning curve models, stable teams are favored against the productivity patterns of project teams (Goleman, Boyatzis, & McKee, 2016).

Thus, the research hypothesis that arises for this factor is:

Hypothesis 2. Self-managed work teams positively influence the collective performance of the project.

Teamwork

The main objective of a work team is to multiply the intellectual capital of an organization, and derived from this, to stimulate new competitive advantages from the development of entrepreneurial skills (Ulrich, Jick, & Von-Glinow, 1993). Collective participation schemes can improve productivity, innovation and the quality of results through the permanent exchange of knowledge and experience (Rousseau, Aubé, & Savoie, 2006).

In pursuance of achieving the goals that have been set, a high degree of commitment and motivation on the part of the people who make up the work teams is required. Ongoing communication among team members strengthens trust and therefore encourages joint achievement of results. Under this precept,

teamwork can be cataloged as a personal competence framed into social relationships that seek to address the needs of a particular context (Le-Boerf, 2002).

In a teamwork scheme, integration elements such as work planning, definition of strategies to tackle it, objectives to be achieved, control processes, solidarity and feedback, cohesion, commitment, permanent communication, and leadership must be included (Leggat, 2007). Under this general framework, the third research hypothesis is proposed:

Hypothesis 3. Teamwork has a positive influence on the collective performance of the project.

Analysis Capacity

Analytical thinking allows the understanding of reality, thus allowing a problem to be divided into smaller parts that may be easier to manipulate, finding more correct and simpler solutions to apply. This type of thinking is characterized by a logical, structured, and inductive order, aimed at finding a solution and a substantial improvement in decision-making (Sternberg, 1999).

Analytical thinking is characterized by logical attention to problems, constant search for improvement against errors based on experience, permanent questioning, and the use of inferential processes in argumentation. It also allows you to be aware of individual strengths, the availability of resources and the purpose of the efforts being undertaken. In general, orderly thinking, reasoning, comparing, synthesizing, deducing and strengthening decision-making (Campirán, Guevara, & Sánchez, 1999).

Thinking skills are directly related to how the individual knows, analyzes, organizes and uses knowledge (Ortiz-Gomez, 2009). Under this premise, it can be inferred that, within the framework of project management, not only technical knowledge is important to achieve success, but also experience constitutes a differentiating factor, based on how the team members manage to interpret reality and make decisions in front of it.

From these definitions, the fourth research hypothesis is proposed:

Hypothesis 4. The analytical capacity of the members of the project team influences the collective performance in a positive way.

Systemic Thinking

Systemic thinking can be defined as the ability to understand the relationships between the different components of a system that is configured to achieve a common end. Organizational structures are supported on processes, resources and people. Systemic thinking seeks to understand organizational changes in terms of their vision for the future (Deming, 2000).

Understanding the organization as a system allows comprehending its degree of complexity and the interaction that is presented between its parts. The systemic approach suggests to think of the company as a whole, making logical connections between the elements that compose it, leaving behind the traditional approach of fragmented analysis, so that, in this way, it was possible to balance the system from processes of continuous improvement, which result in the permanent learning of the individuals who work there (Senge, 2010).

The world must be understood as a whole and not only by the isolated result of each of its parts. Systems dynamics allow us to understand how things change over time (Forrester, 1961). In this sense, and

recognizing, under the triple project restriction scheme: scope, time, and costs, that all the components of a project are related together, and what affects one, results in consequences for another. One can sense that a project must be understood as a system, where all its parts must be integrated and coordinated to reach a common goal, thus allowing the continuous learning of all stakeholders.

According to these reflections, the fifth research hypothesis is proposed:

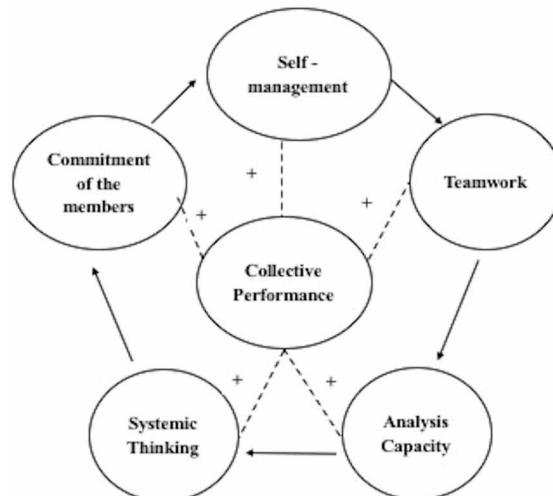
Hypothesis 5. Promoting systemic thinking among project team members has a positive influence on collective performance.

As evidenced from the consulted authors, the group of selected variables exerts a positive action on the collective performance of the project teams. This is strong theoretical evidence that suggests an alternative to improve the efficiency of the people who integrate the work teams. The following is a graphical representation of the relationship of the selected variables:

METHODOLOGY

The present work of investigation is of the quantitative type. In the first part, an interpretative work on bibliographic sources has been developed, based on the consultation of several authors, towards determining the factors that can positively affect the collective performance of the project teams. Subsequently, based on the interpretation of these results, a measurement instrument was designed to assess the selected key factors. Based on the information collected, an analysis of the correlation of variables was performed, which helped to establish a relationship between the factors under study and, therefore, to validate statistically the proposed research hypotheses.

Figure 1. Theoretical model proposed from the relation of the selected variables
Source: Prepared by the authors



Design of the Measuring Instrument

The measurement instrument that was used in this study consisted of 67 questions grouped into seven sections organized according to the variables that were intended to be measured. The objective was for the interviewed project managers to answer each of these questions using a Likert scale described by five options: (1) strongly disagree; (2) disagree; (3) neither agree, nor disagree; (4) all right; (5) totally agree.

In the first section, the information that was required to characterize the surveyed project managers was collected. The second section focuses on inquiring about the collective performance of the projects in which it has participated. The third group of questions is aimed at identifying the degree of self-management of project teams. The fourth group of questions sought to investigate the importance of teamwork and the willingness of team members to work together. The fifth section inquired about the motivation mechanisms that were used to strengthen the commitment of the people who make up the project teams. The sixth and seventh sections focused on determining the importance of systemic thinking and analytical skills.

Validation of the Measurement Instrument

The validation of the measurement instrument focused on determining two key elements: the degree of validity and the index of reliability. To that end, with regard to the degree of validity, and counting with the help of seven experts and extensive experience in research projects, each of the proposed questions was evaluated in three specific aspects: (1) clarity of wording, (2) conceptual approach, and (3) relation of the question to the description of the variable that was intended to measure. Subsequently, the Aiken's V coefficient method was applied to the results that were obtained. Based on these results and on the comments that were made by the experts, the necessary adjustments were made to the questionnaire, thus validating the 67 questions proposed.

On the other hand, a pilot test was carried out for the reliability index, applying the survey to seven other experts, this time with extensive experience in project management, and with the collected data, from which the Cronbach alpha index was calculated, allowing us to show the accuracy of a measuring instrument. As a result of this procedure, a value of 0.973 was obtained, evidencing a high degree of reliability between the collected data and the designed instrument, as well as a positive correlation between the variables under study.

Selection of the Sample

In order to apply the measurement instrument, the project managers of the various small and medium-sized software developers, located in the city of Bogotá, Colombia, were selected as the target population. This sector was chosen because of the easy access to this type of companies. In total, the population belonging to this segment consists of 273 companies (FEDESOF, 2012). From this information we proceeded to calculate the sample, which resulted in a value of $n = 149$ companies. The data sheet of the study is presented below.

RESULTS OF THE INVESTIGATION

Hereafter, the results that were obtained from the study are presented, with the intention of validating the previously proposed research hypotheses.

Profile of the Company and the Project Managers that were Surveyed

The characterization of the companies and the project managers that were surveyed is presented below:

From the 149 companies surveyed, 77% are small because of the number of employees they have, which is between 11 and 50 persons. On the other hand, 23% are medium-sized companies, with a number of employees between 51 and 200. Due to the fact that they are knowledge-generating companies, the number of permanent employees is small, and depending on the projects that are contracted, the personnel required to attend it are recruited.

From the companies that were surveyed, 74% are engaged in the development of information systems for the management of business processes such as accounting, logistics, and human talent programs. The construction and mining-energy sectors are shown as a positive emerging market for the software industry, which is consistent with the Country Strategy that is focused on boosting these sectors.

Also, 49% of the surveyed companies said they did not use any methodology to manage their projects, and 28% stated that they use PMBOK to manage their projects. Despite being 42 companies, this percentage is low for the sample that was taken. However, the PMBOK remains the most recognized methodology in project management.

On average, the duration of the projects undertaken by the managers that were surveyed is 7.5 months. The highest percentage in the frequency distribution occurs in the ranges between 1 and 6 months (32%), and between 7 and 12 months (36%). These results show the interest of the parties in the achievement of results in the short term.

For most respondents, 52%, the ideal software project team should have a number of members between 2 and 6 people. For the case of the experience variable, it is observed that there is a similar distribution among the proposed ranges. While there is no numerical difference, the coincidence lies in recognizing

Table 1. Research data sheet

Characteristics	Description
Period of data collection	From May to July 2016
City of application	Bogotá, Colombia
Size of the surveyed companies	Small and Medium
Main activity of the companies	Software development
Position of person who was interviewed	Project Manager
Population	273 enterprises
Sample	149 enterprises
Confidence level	95%
Degree of accuracy	5%
Collection medium	Personal interview, printed interview.

Source: Prepared by the authors

Table 2. Profile of the sample

Descriptor		Frequency	Percentage
Quantity of employees	Between 11 and 50	115	77%
	Between 51 and 200	34	23%
Developed systems	Business systems	110	75%
	Web software	13	9%
	Health software	13	9%
	Control software	10	7%
Industry or Sector	Business services	73	49%
	Construction	23	15%
	Mining-energy	13	9%
	Banking	12	8%
	Public	11	7%
	Industrial and production	6	4%
	Pharmaceutical	5	3%
	Health	3	2%
	Education	3	2%
Project management methodology used	None	73	50%
	PMBOK	42	29%
	SCRUM	13	9%
	Own methodology	10	7%
	CMMI	7	5%
Project expected duration	Between 1 and 6 months	54	36%
	Between 7 and 12 months	47	32%
	Between 13 and 24 months	33	22%
	More than 24 months	15	10%
Size of the work team	Between 2 and 6 persons	77	52%
	Between 7 and 10 persons	42	28%
	Between 11 and 15 persons	20	13%
	More than 15 persons	10	7%
Experience	Between 1 and 2 years	51	34%
	Between 3 and 5 years	50	34%
	More than 5 years	48	32%
Academic training	Professional	38	26%
	Specialization	79	53%
	Master degree	32	21%

Source: Prepared by the authors based on the collected data

the project leader's experience as a key to success. For the case of the training level of the project leaders, the vast majority (53%) have attended a specialization program. It is also important to underline that 21% have completed master's degrees. This is a reflection on how more and more professionals are looking to complement their experience with academic training.

Relationship Between Selected Variables

In order to validate the proposed research hypotheses, a regression model to establish the correlation index between the identified variables was applied. The following are the results that were obtained:

Hypothesis 1. *Strengthening the commitment of the project team members influence collective performance in a positive manner.*

Based on these results, we can observe a positive relationship between the independent variable *commitment* and the dependent variable *collective performance*, as explained by the coefficient of determination R^2 that shows a result of 0.8849. In other words, the coefficient of determination confirms that when there is a high commitment among the people who make up a project team, this has a positive influence on the collective performance of all its members. The two variables compared are close to 89%, according to the collected data.

Hypothesis 2. *Self-managed work teams influence the collective performance of the project in a positive manner.*

For the case of the *self-management* variable, we find a coefficient of determination R^2 of 0.8363. This allows us to conclude that work teams in which members are able to self-manage their daily tasks without requiring exhaustive supervision have a better performance than those in which control is pre-

Figure 2. *Results of the regression for the correlation of variables: commitment and collective performance*
Source: Prepared by the authors out of processing the collected data

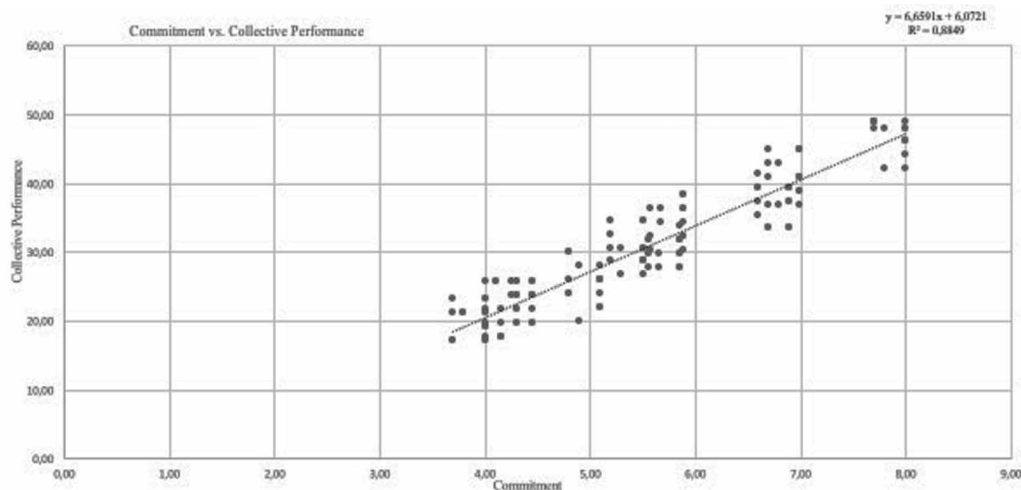
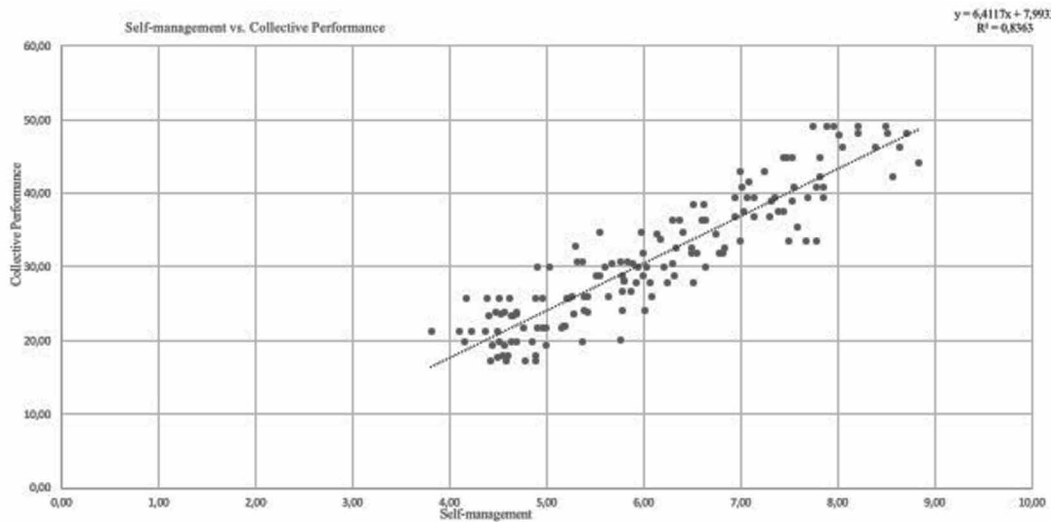


Figure 3. Results of the regression for the correlation of variables: self-management and collective performance

Source: Prepared by the authors out of processing the collected data



dominating. In this vein, the effectiveness of the *collective performance* is positively impacted by *self-management*; this conclusion is consistent with what has been stated by the various authors consulted, for whom this competence is a fundamental characteristic of high-performance teams.

Hypothesis 3. *Teamwork has a positive influence on the collective performance of the project.*

Regarding *teamwork* competence and its relation to *collective performance*, we see how the coefficient of determination R^2 gives us a result of 0.8801 allowing us to infer, with the collected data, that there is a positive relationship between both variables.

Hypothesis 4. *The analytical capacity of the members of the project team influences the collective performance in a positive way.*

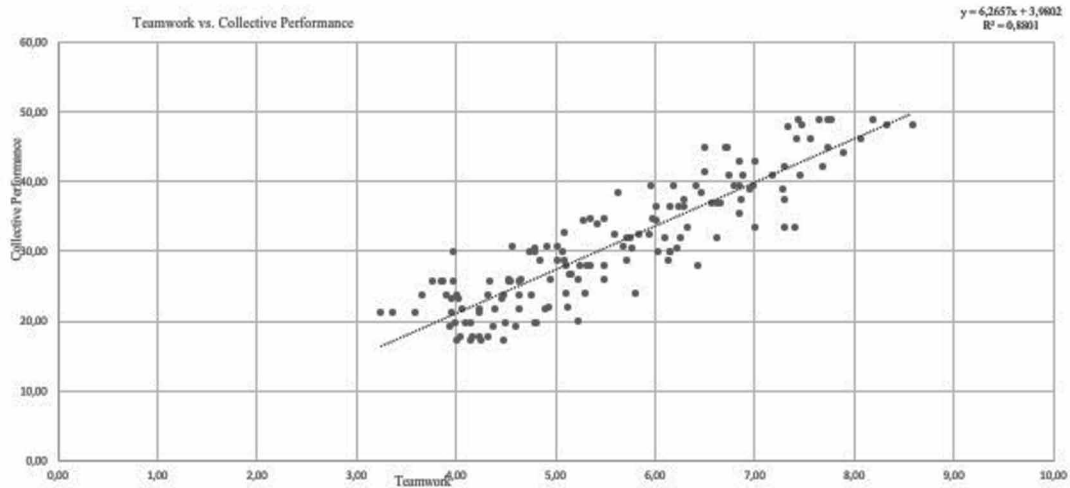
As far as the *analytical capacity* is concerned, a coefficient of determination R^2 of 0.8104 was obtained, with which it can be concluded that people who have a high degree of development of this competence and integrate a work team, exercise a high influence on the performance of a project. This is consistent with the idea that a project should be divided into parts in order to improve the effectiveness of its management.

Hypothesis 5. *Promoting systemic thinking among project team members has a positive influence on collective performance.*

Finally, for the case of the *systemic thinking* variable and its relation to *collective performance*, we can see how the coefficient of determination R^2 yields a result of 0,8003 indicating a positive relation-

Project Management With High-Performance Work Teams

Figure 4. Results of the regression for the correlation of variables: teamwork and collective performance
Source: Prepared by the authors out of processing the collected data



ship between both variables. This reinforces the importance of understanding reality as a whole, and not simply as one of the parts that is executed by each person who conforms the project team. A high-performance team is characterized by sharing a common goal and this is how each one of its members must understand it.

On the other hand, in addition to the simple and individual linear regressions performed with each of the independent variables, the data were processed in a multiple regression, to determine the influence

Figure 5. Results of the regression for the correlation of variables: analytical capacity and collective performance
Source: Prepared by the authors out of processing the collected data

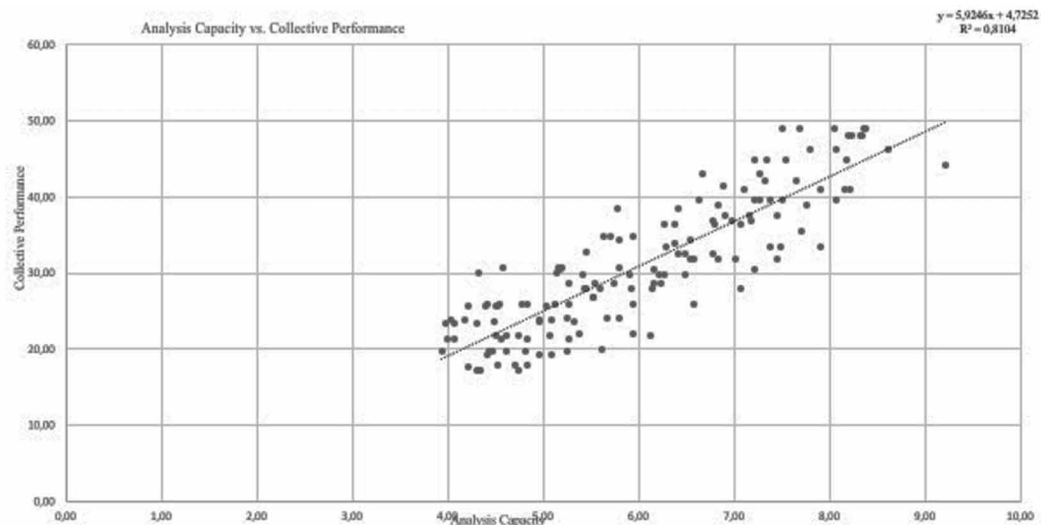
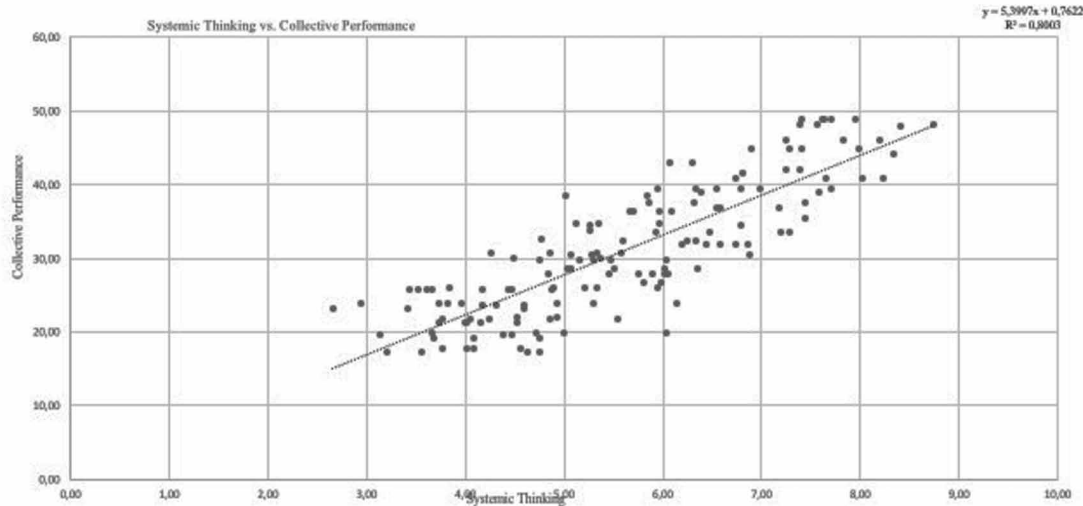


Figure 6. Results of the regression for the correlation of variables: systemic thinking and collective performance

Source. Prepared by the authors out of processing the collected data



that is exerted by the group of independent variables on the identified dependent variable. Table 3 shows the results that were obtained for the adjusted coefficient of determination:

As it can be seen in table 3, the adjusted R^2 that was obtained from the application of the multiple regression model, presents a slight increase in comparison with this same coefficient obtained in the simple linear regressions at an individual level. This allows us to conclude that, in the whole, the five independent variables: commitment, self-management, teamwork, analytical capacity and systemic thinking, exert a positive influence on the dependent variable: collective performance. Thus, it can also be said that the collective performance of the project teams is explained by these five variables, that is to say, a high-performance project team is characterized by having these competencies highly developed at an individual level.

FUTURE RESEARCH DIRECTIONS

From the results obtained in this research, it will be possible to develop, as future research, the characterization of the leadership styles required, depending on the project team. This will allow project leaders

Table 3. Adjusted coefficient of determination R^2 obtained from multiple regression

Joint coefficient	Commitment	Self-management	Teamwork	Analytical capacity	Systemic thinking
0,8857	0,8848	0,8362	0,8800	0,8103	0,8003

Source: Prepared by the authors out of processing the collected data

to manage their profile more effectively, so that the likelihood of project success improves through the application of good management and leadership practices.

CONCLUSION

- The profile of the people who conform a work team is a key success factor for a project. Identifying the generic key competencies that team members must have facilitates selection processes and allows focusing efforts on what can really add value to the project.
- The work teams of the knowledge society are characterized by having a high degree of freedom in decision-making in relation to the work that has been assigned to them. Likewise, all members of a team are able to understand what their contribution to the expected results is and how the degree of interdependence with other team members is.
- The five generic competencies that were identified: commitment, self-management, teamwork, analytical capacity, and systemic thinking are essential in any project and allow for faster and easier progress along learning curves.
- A high-performance leader must identify what the main motivations of the people who comprise the team are, in this way he will be able to manage them and this will be reflected in a significant increase in productivity and the quality of the results that may be achieved.
- Nowadays, the discipline of project management is of great importance in management models; this is due to its strong focus on obtaining results, as well as the structured way to reach the outlined objectives. Undoubtedly, this is achieved through the performance of people, which mark the difference between a successful project and a failed project.
- A high-performance team achieves a “total synchrony” inasmuch as it shares different experiences and draws different situations, which is why the permanence of its members is one of the decisive factors that impact on the behavior of the team and of its members.
- Individual efforts, which do not generate value on a common goal, can be classified as a waste of time and energy. The members of a high-performance team are clear that the whole goes beyond the sum of its parts, which is why they manage to understand reality as a system.
- The analytical capacity is a fundamental competence in the members of a high-performance team, since it is from this point that they manage to divide a problem into easily manageable parts and in this way to solve the challenges that are traced by a project.
- In order for a work team to achieve high performance, their personal and professional competences must have a high degree of alignment with the objectives that have been set. This is why, in addition to the five generic competences mentioned above, the specific competences that are required by people to function correctly in relation to the work that has been planned must be identified. These specific competencies are related to the necessities of the project and its level of complexity.
- As a final conclusion, generic competences mark the values and attitudes of a person against an outlined goal, which is why they are a decisive factor to achieve success in a project, regardless of its nature. Thus, based on the results that were obtained in the present study, it has been possible to validate the established research hypotheses and therefore to establish the generic competences that influence the collective performance of the project teams in the positive way.

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KEY TERMS AND DEFINITIONS

Correlation: Statistical technique used to determine the relationship between two or more variables. They take a value between 0 and 1.

Empowerment: It is the fact of delegating power and authority to subordinates and giving them the feeling that they own their own work.

Linear Regression: A mathematical model used to determine the dependency relationship between a dependent variable and one or more independent variables. It also allows to identify the degree to which a dependent variable can be predicted by the independent variables.

Project Management: This chapter takes the definition of the *Project Management Institute*, which is the application of knowledge, skills, tools and techniques to project activities.

Sustainability: It refers to the capacity of a society and of nations to implement strategies that allow satisfying the necessities of humanity today, compromising neither resources nor the development of future generations.

Chapter 2

Trends in Management of TI Projects and CEO Competence

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ABSTRACT

The purpose of this article is to expose the articulation that should exist between the CEO's competences of projects and TI's business processes with an effective management for the execution, follow up, control and closing of projects, making emphasis in the planning and management areas which are the ones that relieve the complexity as an intangible reality within the unstable environment of changes and competition in which companies or organizations move. An analysis of technological surveillance was done which explains the traceability and importance of the areas and their relationship with the timely and accurate decision making, as long as processes are taken into account such as strategic management, risk management, adequate administration of resources and time, as well as soft elements associated to leadership and emotional intelligence that the TI projects and processes' CEO should have. Under these circumstances, competences of CEOs are raised and how they manage the dynamic organizational scenarios.

INTRODUCTION

From the Rouach's perspective (1996), the technological surveillance is the art of discovering, collecting, treatment and storage of information and pertinent signals, weak and strong, which will allow

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to guide the future. Considering the importance of designing training proposals with future vision, a Technological Surveillance exercise was done about two areas of TI projects execution: Planning and Management of Projects. The above, with the purpose of identifying the main trends associated to the knowledge fields and using this information as an input for the definition of the pertinent CEO's profile, against the investigative bets done on the global context about the topic.

With this purpose, more than 913 articles were analyzed using the data mining software VOS viewer, to study 6 bibliometric indicators that allowed to understand the planning and management field in the CEO's context, which the projects management needs: 1) dynamics of publication in time. 2) Publications by language, 3) dynamics of publication by country on the knowledge field, 4) dynamics of publication by research areas, 5) more relevant authors over thematic and evolution of interest in thematic associated to the knowledge field. For the presentation of results of the exercise, the planning and management of the exercise get articulated, aligned with competences which a manager must have to guarantee the success during the execution of TI projects.

BACKGROUND

The literature review to make the technological surveillance exercise, associated to the study topic of this research, was based on the Cetisme's Project proposal (2002) adapted by Moreno (2003), consisting of six phases synthesized on Table 1 which describes that, on Phase 4, it was necessary to structure two search equations, one for each area of management and another one for the planning area. These equations are shown on Tables 2 and 3, which at the same time, present the filtering process generated for a further analysis of trends on resulting products.

Trends Analysis on the Planning Area

The Figure 1 presents the publication dynamics in time associated to the planning area in the projects context, it is found that, on the first years of the time line, a special interest was generated towards topics related to methodologies for decision making that would allow the development of planning processes making emphasis on the risk mitigation in projects (Gidel, Gautier & Duchamp, 2005), and potentiate the knowledge management processes on the implementation phases (Saad, Rosenthal-Sabroux & Grundstein, 2005).

Table 1. Methodological structure of a technological surveillance exercise

Phases	Description
Phase 1: Definition of objectives	Identification of search trends in the planning and projects managing field
Phase 2: Identification of information needs.	Scientific articles published in indexed magazines in recognized databases.
Phase 3: Identification of information sources	Selection of the Web database of Science as source of information.
Phase 4: Search of information	Definition of search equations, with key words associated to each area.
Phase 5: Analysis and validation of information.	Processing of information using software and Vosviewer
Phase 6: Preparation of report	Summary of results for consolidation of final document.

Table 2. Methodology for trends analysis on the planning area

SEARCH EQUATION PLANNING AREA	
TITLE: ("Project formulation" OR ""strategic alignment" OR Project design" OR "decision making process" OR "strategy alignment" OR "strategy" OR "organizational culture" OR "innovation culture" OR "business mission" OR "value generation" OR "strategy vision" OR "strategy management" OR "strategy management" OR "success factors") AND TITLE: (project or projects)	930 documents
Filter only Articles	759 documents
Filter for knowledge field	435 documents
Management OR Civil Engineering OR Industrial Engineering OR Environmental Sciences OR Engineering Multidisciplinary OR Economics OR Business OR Green Sustainable Science Technology OR Multidisciplinary Sciences OR Social Science Interdisciplinary OR Development Studies	

During recent years, the number of published articles on the Web of Science database about the topic, has experienced a growing trend, showing interest on the knowledge field. For year 2019 (abril) generated articles triple the total ones published during 2015 on the topic. The latest research on the topic show a special emphasis in the identification of new methods for the strategic decision making. (Toledo Gandarias & Otegi Olaso, 2019), particularly, in approaching these processes in within complex scenarios, and from the perspective of innovation methodologies (Rumeser & Emsley, 2019). Finally, studios were identified oriented to understand critical factors for success in the development of projects in the context of TI (Pacagnella da Silva, Pacífico, de Arruda Ignacio, & da Silva, (2019) and in the infrastructure sector (Muhammad & Johar, 2019). As a complement of the above, Figure 2 shows that the most relevant language for publications made in the time line, is English with more than 400 publications written in this language.

On the technological surveillance exercise, the publication by country dynamics was analyzed, (see Figure 3), there, it was evident that China and the United States are the countries with greater interest the thematic area. It was also found that there are still challenges in Latin-America, and in the Colombian context, upon increasing the number of publications on the knowledge field, it is evident that Brazil and Chile are the only countries of the region with publications on the topic. Particularly, in Brazil, the research on project planning, has been focused to understand success factors in several type of projects, which include even those oriented towards knowledge transfer between actors of the TI innovation eco-

Table 3. Methodology for trends analysis on the management area

SEARCH EQUATION MANAGEMENT AREA	
TITLE: ("innovation" OR "agile methods" OR "agile methodologies" OR "risk* management" OR "resource*management" OR "budget* management" OR "strategy communication" OR "leadership" OR "technology management" OR "quality management" OR "coaching" OR "stakeholders management" OR "negotiation skills" OR "bargaining power" OR "certification" OR "accreditation") AND TITLE: (project or projects)	1288 documents
Filter only Articles	1048 documents
Filter by knowledge field	478 documents
Management OR Civil Engineering OR Industrial Engineering OR Environmental Sciences OR Engineering Multidisciplinary OR Economics OR Business OR Green Sustainable Science Technology OR Multidisciplinary Sciences OR Social Science Interdisciplinary OR Development Studies	

Figure 1. Publication dynamics in time

Source: Developed by authors with information from WOS (2019) and VOSViewer ®



systems. (Saito, Rojas Lezana, & Cauchick Miguel, 2016), up to those integrating advanced techniques for quality management as projects with Six Sigma (Marzagão & Carvalho, 2016) approach. In Chile, the latest surveys have been oriented to the analysis of planning dynamics for innovation projects, showing as relevant the study of flexible methodologies for the development of processes that generate propulsive answers against the market demands (Galvez, Enjolras, Camargo, Boly & Claire, 2018).

Figure 4 shows the main areas of research interested in thematic associated to TI Projects Planning. It was found that, most of research is centered in areas of business economy, engineering, environmental sciences, sciences associated to technology, technologies for construction, social sciences, among others. Figure 5 shows the main authors who publish about the knowledge field, and it is found that the most prominent author is professor Albert P.C Chan, from the Construction Department in The Hong Kong Polytechnic University, his main interest has been centered in analyzing critical factors, and dynamic policies in infrastructure projects integrating public-private alliances (Osei-Kyei, & Chan, 2017) and which are implemented in development countries (Ameyaw, Chan, & Owusu-Manu, 2017). The above, not only shows the importance of the planning area in the CEO's profile, but highlights the relevance of formation competences in the Colombian context, which as a developing country has similar challenges to the researched ones by the author above mentioned.

Finally, it was identified the evolution of thematic of interest associated to the planning area in the projects context. For that, key words of the 435 articles object of this study were analyzed. For visualization effects, key words were prioritized that were found in more than 3 articles within the analysis

Trends in Management of TI Projects and CEO Competence

Figure 2. Publications by language

Source: Developed by authors with information from WOS (2019) and VOSViewer ®

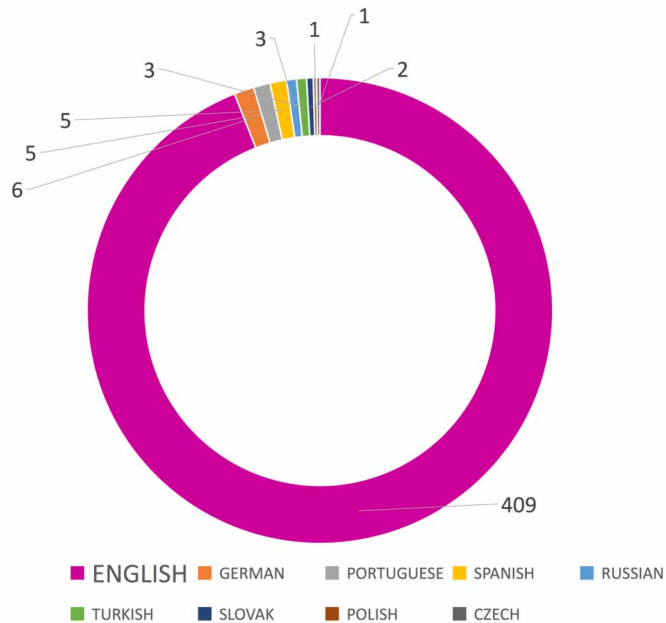


Figure 3. Publication dynamics by country in the knowledge field

Source: Developed by authors with information from WOS (2019) and VOSViewer ®

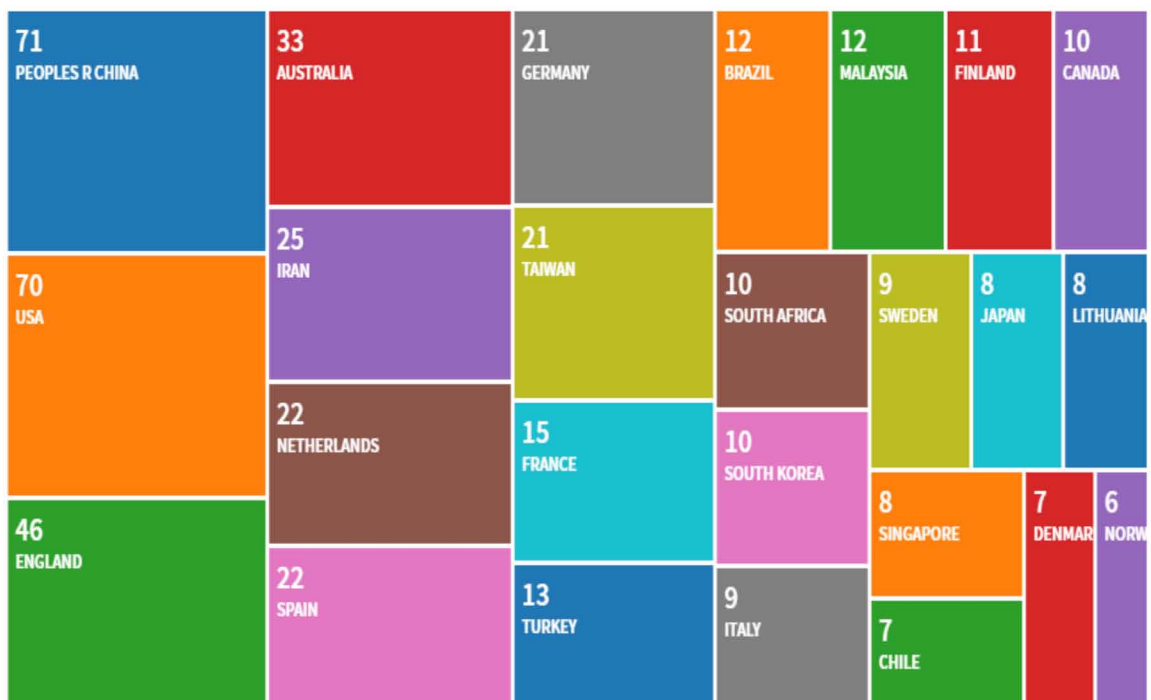


Figure 4. Publication dynamics by research areas

Source: Developed by authors with information from WOS (2019) and VOSViewer ®



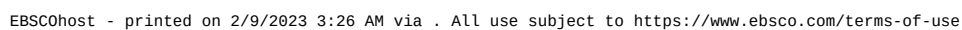
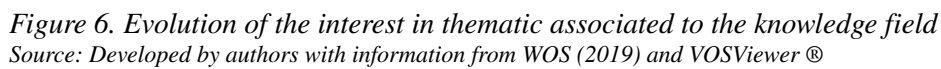
database. The result of the co-relation map is shown on figure 6. This map shows that the research on TI projects planning has been focused on the analysis of critical success factors, for the strategic decision making, in the study of strategies for the knowledge transfer, and finally, it was found a special emphasis in the analysis of planning strategies oriented towards the mitigation of projects' risks.

Analysis of Trends on Management Area

Figure 7 shows the publication dynamics in time associated to the management area in the context of TI projects, it is found that, on the first years of the timeline, a special interest was generated towards related design of management for risk's models (Dey & Mukherjee, 2005). Some research stands such as Mulec and Roth (2005) focused to analyze the coaching of teams to support reflection and learning within teams leading I+D global projects.

In timeline, it is evident a growing interest in the topic study, finding that in 2019 (April) the number of articles published was duplicated compared with the total amount of articles published on 2005. The latest research has been focused on the comprehension of projects management in innovation dynamics. About it, studies have been carried out, such as Bürger and Moser's (2019), where management methodologies are proposed, and project management and evaluation integrating open innovation vision. Aligned with this thematic is found the research of Pchelintseva, Gordashnikova, and Vasina (2019), who were oriented towards the definition of performance indicators in project innovation, or Schuur-

Figure 5. Most relevant authors about thematic
Source: Developed by authors with information from WOS (2019) and VOSViewer®



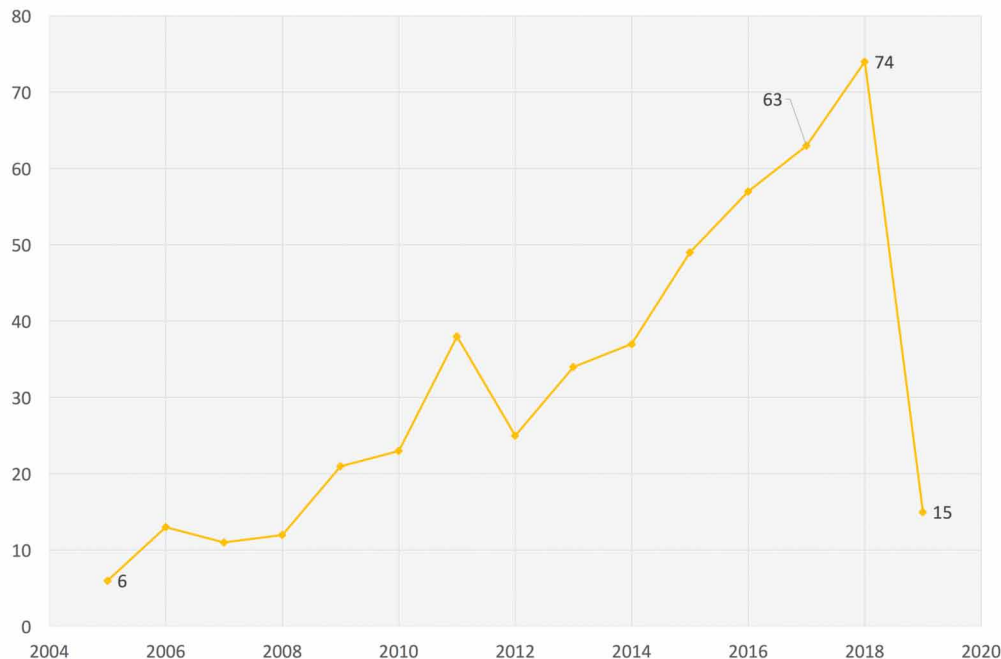
man, Herregodts, Georges and Rits' (2019), who propose analytical models to facilitate management processes of change project. Complementing the above, it was found that most of publications have been made in English (Figure 8).

In accordance with the presentation in figure 9, it is found that upon analyzing the dynamics of publications by country (see Figure 12), countries with the greater number of publications about TI project management are the United State, England, China and Australia. In the context of Latin-America, the country with a bigger representation in terms of publications on thematic, is Brazil. In this country, research has been focused on the study of the importance of the reliability value in the management processes of stakeholders in the projects (de Oliveira, & Rabechini Jr, 2019), in the relevance of leadership styles of agile and successful project management (Raziq, Borini, Malik, Ahmad, & Shabaz, 2018); and finally, on the importance of integration of agile innovation methodologies for the project management based on the Design Thinking and in gamification processes (Higuchi & Nakano, 2017).

Figure 10 shows the main areas to which research of TI project management has joined. Most part of studies are concentrated in the areas of business economy, engineering, operations research, construction technologies, among others. In terms of authors (see Figure 14), it was found that the most relevant author in the study of thematic is professor Martin Hoegl from the Institute for Leadership and Organization (ILO) of the University of Múnich. His main research interest is oriented towards study of leadership in the processes of TI project management. Particularly, two of his research studies stand out which study this thematic in the context of virtual teams, and geographically dispersed. (Muethel & Hoegl, 2011) managed through shared leadership (Hoegl & Muethel, 2016).

Figure 7. Dynamics of publications in time

Source: Developed by authors with information from WOS (2019) and VOSViewer ®



Trends in Management of TI Projects and CEO Competence

Figure 8. Publications by language

Source: Developed by authors with information from WOS (2019) and VOSViewer ®

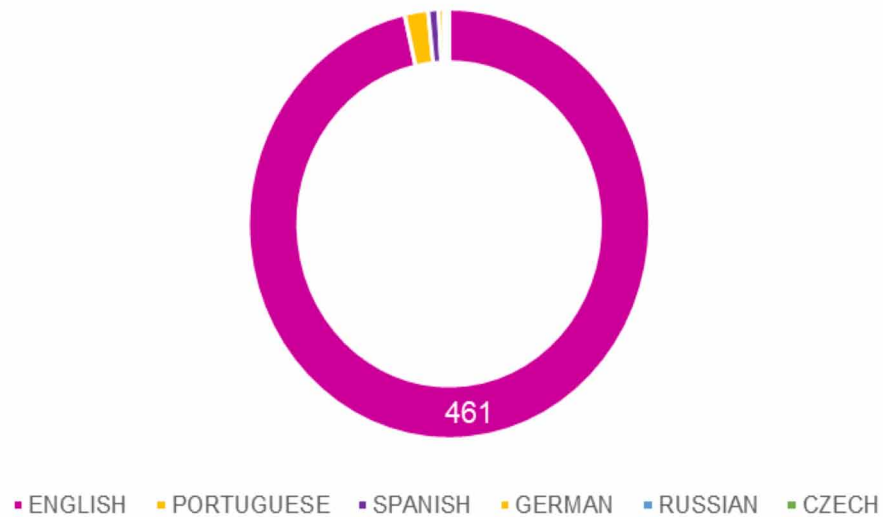
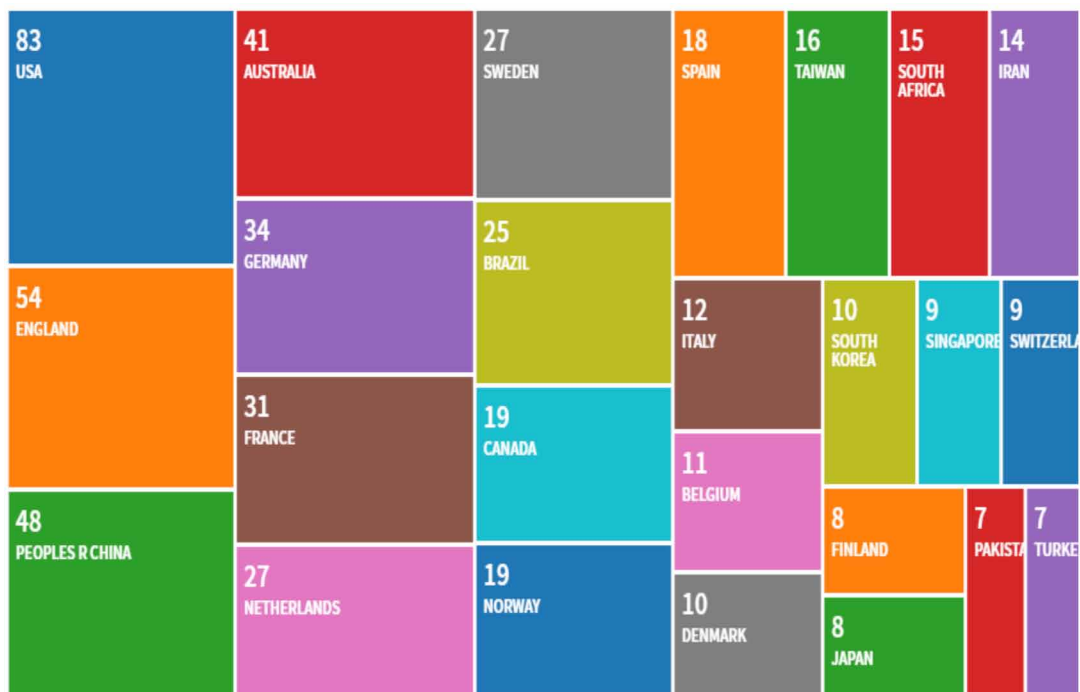


Figure 9. Dynamics of publications by country in the knowledge field

Source: Developed by authors with information from WOS (2019) and VOSViewer ®



Finally, evolution was identified in thematic of interest, associated to the Management area, in the context of TI projects. For that, key words were analyzed from the 478 articles object of study, for visualization effects prioritization was done of those key words that were present in more than 3 articles. The result of the co-relation map is shown on Figure 12. From the map, we conclude that, among the main topics related to the TI project management, we find the risk management, innovation management, knowledge management, management of interested parties and finally, the study of leadership roles for the management of projects generating results of positive transformation within the contexts where they are developed.

MAIN FOCUS OF THE CHAPTER

The chapter deepens on competences that a CEO should have against associated topics of planning and TI project management that is why after evaluation of areas, emphasis will be made in competences.

Figure 10. Dynamics of publication by research areas
 Source: Developed by authors with information from WOS (2019) and VOSViewer ®



Trends in Management of TI Projects and CEO Competence

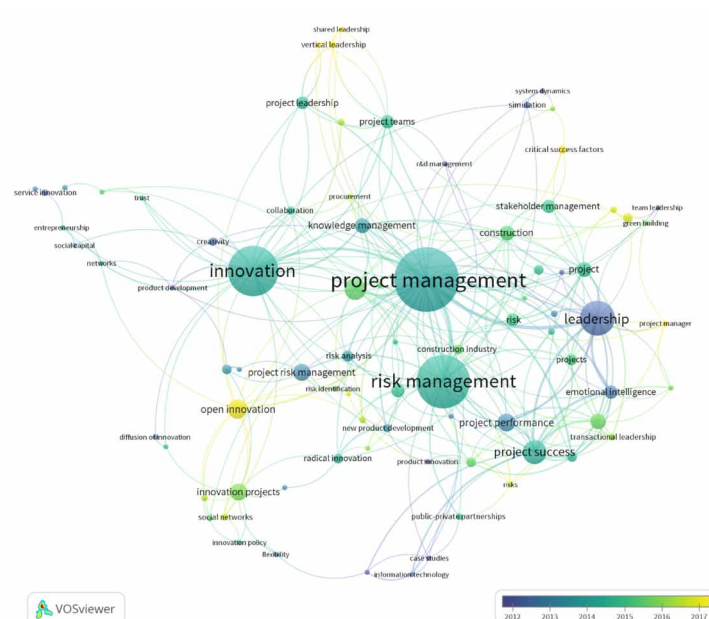
Figure 11. Most relevant authors about thematic

Source: Developed by authors with information from WOS (2019) and VOSViewer ®



Figure 12. Evolution of interest in thematic associated to the knowledge field

Source: Developed by authors with information from WOS (2019) and VOSViewer ®



Competences of a CEO in the World Context, Latin-American and National in the Business Management

Within this context, it is necessary to describe how competences of a CEO strengthen the strategies to successfully approach the objectives of Project Management, contributing to positioning of organizations, from which projects are planned, executed, controlled and closed.

The CEO's Role (Chief Executive Officer) on the Project Management

Definition of the CEO's role in the actual context of project management, including the business management, may result a non-easy task, in spite of innumerable sources of information that are currently available, and to say the truth, the dynamism that characterizes the business development, confronting every time more demanding challenges, forcing the CEO's role to be likewise dynamic.

Some authors refer to a CEO such as that responsible and authorized person for general management and handling of an organization, and its different operations, accountable for the development of business plans, commercial strategies and even motivational aspects of staff under his charge (Vilkinas, 2015).

A sinecuanum quality attributable to an CEO is his leadership ability, and here at this point is convenient to stop and analyze what the term leadership implies, since from a conservative point of view, leadership was understood as an organizer (Yukl y van Fleet, 1992) (Anderson, Ones, Sinangil, & Viswesvaran, 2005), (Castro & Fernández, 2006). On the last decades the conception has changed, and leadership is interpreted as the ability of a leader to generate confidence, (Dirks y Ferrin, 2002) and at the same time the quality to be authentic (Walumbwa, Avolio, Gardner, Wernsing & Peterson, 2008) and being a model of ethical conduct and responsible (Brown, Treviño & Harrison, 2005). As it is seen, the contemporary conception of leadership is inclined towards a moral and behavioral component, (Knights & Leary, 2006).

Theoretical Basis

Within leadership, what should characterize a CEO is stated in two generalized tendencies: the first one is about a transactional leadership, whose main focus is in established goals, and the leader is a conductor or guide for his collaborators (Antonakis, 2017), it is about a focused approach on results where the participation of the leader is sometimes passive, and is limited to reprove when established standards for the accomplishment of proposed goals are not fulfilled (Eagly, Johannesen-Schmidt & Van Engen, 2003). This type of leadership is far from the one that a CEO should assume, because although this contributes to the goals fulfillment, it very often puts aside the growth and particular interests of collaborators from the organizations.

On the other hand, there is the Transformational Leadership which is much closer to what it actually is expected from a CEO, and where the main role of a leader is to inspire his collaborators to transcend from his individual interests towards common and collective goals. In this type of leadership, for the benefit of reaching goals, it is conceived as a synergy between the individual and collective efforts from the leader as well as from his collaborators. (Bass & Steidlmeier, 1999).

The transformational leadership results are highly positive for those working in a company, as well as for his chiefs, since great levels of individual and group performance are reached (Wang, Oh, Courtright & Colbert, 2011). The transformational leaders who become the actual CEOs, have the ability to increase and motivate his collaborators in the sense of being self-efficient (Walumbwa, Avolio & Zhu,

2008), they promote creativity of all employees from the organization (Shin & Zhou, 2003; Zhang & Bartol, 2010) and, they generate commitment (Avolio, Zhu, Koh, & Bathia, 2004; Dvir, Kass & Shamir, 2004) and welfare (Liu, Siu & Shi, 2010).

Transformational leadership becomes the formation base of the CEO, although in the historical review it is evident that the attention towards this leadership figure has become real only at the beginning of the 90's, according to Quigley y Hambrick (2015). The first CEOs were hired externally by companies with clear objectives of change for companies and, little by little changed from being only plan executors to promoters of organizational performance.

The CEO's work is characterized for being of multi-faceted type, and besides that, they are considered elitist propagators and excluding, with discourses biased toward goals. (Simón, 2017), always careful in his speech (Kleiner, 2003). And it is said that the CEOs look at the world through an organizational culture they maintain in their organizations in pursuit of continuous improvement in the performance of their organization (Berson, Oreg & Dvir, 2008; Finkelstein & Hambrick, 1996). Figure 13 shows some of the functions to which a CEO is confronted in the day to day of his company.

As shown in figure 14, a CEO suggests strategies that allow him to energize and project his company, he also identifies potential risks to which the company may be exposed, and prepares it to overcome any unforeseen situation, he motivates his employees and collaborators to improve the organizational environment of the company, manages financial reports of the company, making sure to have enough and detailed information on the most relevant aspects of the what to do of the organization, and he supervises the resources allocation for tasks to be performed.

With all functions that a CEO keeps under his control, it is important for him to know the difference between tasks he should undertake directly, and which ones he should delegate. Figure 2 proposes an

Figure 13. Some CEO's functions

Source: Adapted from (Flores & Vanoni, 2016)



algorithm which allows the optimization of functions to be performed by the CEO, starting from the reception of tasks and assignments that may come from the main staff of the organization, or simply be dictated by the actual situation being faced by the company, for example the launching of a new product or entering in new markets.

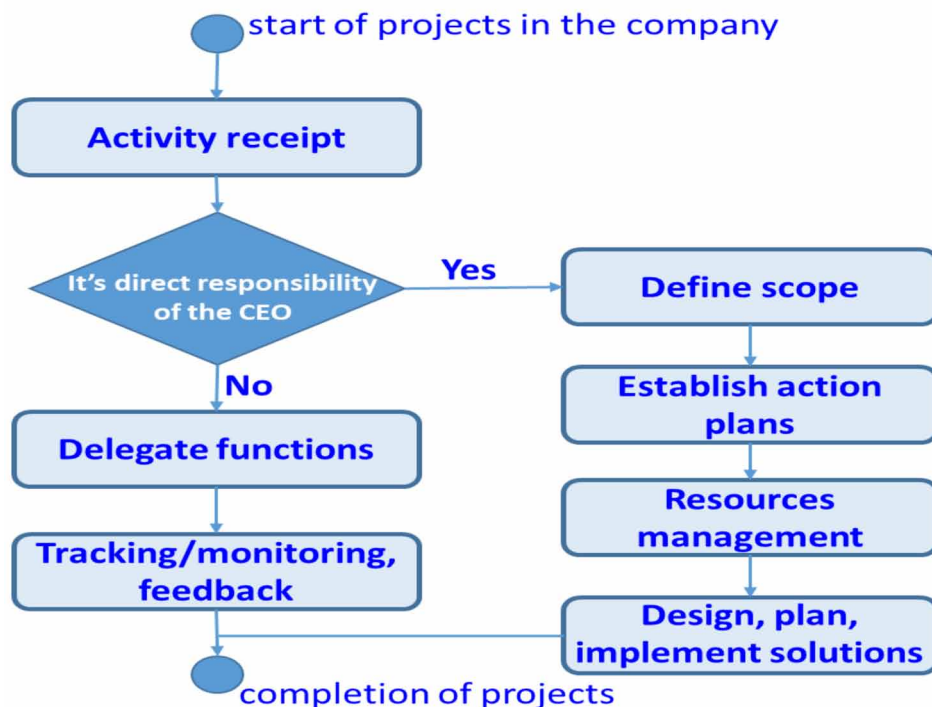
The following logic phase poses a decision making related to the direct influence level that the CEO has or does not have for each task arising in the company. This situation leads to a slowdown in decision making that makes the leadership process that the CEO should exercise inefficient. If the activity to be performed is the CEO's own, then he should proceed to define the scope of such activity, he should establish the action plans to be followed, in order to carry out the assigned task, managing the resources with which the activity will be performed, and which is his direct responsibility. Finally, he designs, plans and implements the solutions.

In the case when the task is not a direct competence of the CEO, other members of the organization should be delegated to carry out the tasks, but the CEO should always be committed to monitor, supervise and give feedback during the performance of activities being carried out by other members of the business team.

The CEO's Competences: A Book at the Global Context

In an increasingly globalized world, where knowledge is open to everybody without further discrimination, paradoxically we see that there is a deep difference between industrialized countries as the United

Figure 14. Algorithm of decision making for appropriation and delegation of a CEO's functions
Source: Authors



Trends in Management of TI Projects and CEO Competence

States, Japan, the United Kingdom and China regarding the greatest number of CEO qualified as excellent and of high performance.

The world ranking from the magazine CEOWORLD, of the best executive directors for 2018, measured more than 1,800 CEOs in 96 countries. Keeping in mind criteria linked to performance of the business, and external evaluations from associations, the methodology is mainly based on financial returns of the total CEO's mandate, which represents sixty per cent (60%) of final classification, different than the price of shares and the actual quarter figures (taken from <https://ceoworld.biz/2018/10/12/best-ceos-in-the-world-2018/>). The remaining 40 per-cent is taken from the internal evaluation of companies and their staff about performance of their managers.

Figure 15 shows the CEO's specialists concentration evaluated with the highest standards, based on internal and external criteria of international companies, organizations and entities from the official sector as well as from the private sector.

Obvious questionings arise here in the sense of what criteria have been developed at an international level for the selection of CEO as executives of high performance. Although it is difficult to establish consensus, the international experience shows some general guidelines on this respect.

Table 4 shows some general aspects of what organizations focused on the high performance evaluation of CEO, consider determinant upon establishing a qualification of high performance CEOs (Pasmore, 2014).

International trends are oriented for a CEO to become a transformational leader, people focused in planning and taking the organization in uncertain and challenging future, to operate at strategic level,

Figure 15. Number of CEO of high performance by country, for year 2018

Source: CEOWORLD, 2018.

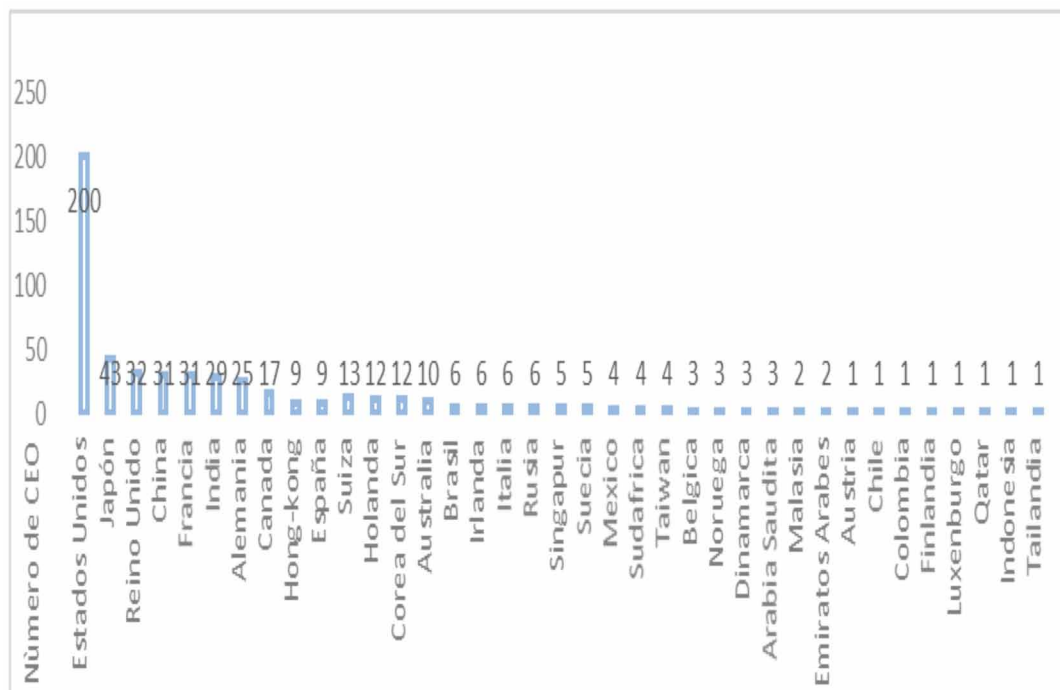


Table 4. Evaluation criteria for selection of a CEO

Global criterion	Definition
Experience	To have adequate qualifications for work, matching it with his education and experience in similar administrative positions. This is a necessary criterion, but not enough for selection.
Personal	Who is the person? What are his ideals? his ethics, What does he think? and How has his relationship with collaborators staff and previous bosses been?
His network	Who do you know inside and outside the company? Have you found, and can you find help easily in crisis moments? Do you have people, friends, and colleagues that can offer you assistance and help?
Interpersonal Relationships	How is your relationship with others? How do you win respect and leadership from people?

Source: Adapted from (Pasmore, 2014)

managing human and physical resources, through changes, to be troubleshooters, innovators, brave and efficient, and understand the importance of all interested parties in the company's business, sending clear messages during periods of crisis (Australian Transformation and Turnaround Association, 2018).

Requirements at world level for the CEO are increasing every time, since his leadership easily migrates from the government plan to the private plan, and it becomes a reason for little amazement the fact that for example the United Nations point out that from the 100 biggest economies of the world, are companies, not countries. And from there, it is expected from companies and organizations, the same as it used to be before for countries, as their social responsibility and tasks of identity building that are obviously transferred to the CEO as it used to be with presidents and government chiefs (Pless & Maak, 2010).

A Little of National Context: Colombia and its CEO Before the New Dynamics for Changes

The Colombian CEO are a development engine starting from the input of their intelligence and experience to adapt themselves to new contingencies, transforming the new scenarios of demand for growth opportunities. Colombian organizations are focused on an increased digital management, experience such as RAPPI is an example of this and how their CEO display their versatility and adaptability in front of social crisis as the migration from neighbour countries. It is foreseen that before 2020, about 44% of Colombian CEO will join to industry consortiums focused on the development of innovating technologies of digital type, 40% of them will collaborate with innovating start-ups for telemarketing, And about 36% of them will open speeding-up programs or incubators of new companies, and business opportunities in Colombia and abroad (KPMG, 2018).

These new scenarios with no doubt cause challenges for Colombian CEO about competences such as the ability to adaptation of changes, give priority to innovating ideas more than knowledge among others. The Colombian environment has understood that economy, business and social development have changed, going from an industrial era to one of information and then to a phase of imagination. Table 5 summarizes the trend changes of above-mentioned phases.

An important challenge for a Colombian company is digitization, and it is precisely through digital transformation of organizations where a process of combination of technology and the human resource potential is called to be established in a synergistic way. An approach towards the power of innovating ideas, understanding that technology is a tool to reach the goals, and it should not become the main pur-

Table 5. Business development phases in Colombia and the world

	Industrial era	Information's era	Imagination's era
Main characteristics	Focused on tasks development. Measured stage Where control meant power. Where knowledge was focused on only one person. There was no feedback. Management was systematic in the processes.	Focused on people. A phase of brave people. Knowledge is the key factor for power. Knowledge is for many. A way of feedback. Entrepreneurs are visionaries.	Focused on mental power, in the brain. A vulnerable phase. Anyone can have access to knowledge and have it. Ideas mean power. Each process can have feedback. It is a phase for creators and innovators.

Source: (KPMG, 2018)

pose of business development. Technology is one of the guidelines that should mark the new scenarios for the development of companies and organizations of the country (Marulanda, 2018).

Colombia is pioneer in counting with a base line for advanced technology adoption, in productive sectors such as shown by figures from the digital economy observatory, attached to the Ministry of Information Technology and Communications (MinTIC) (<https://www.mintic.gov.co/portal/604/w3-article-61929.html>). Figure 16 shows the behavior of companies of Colombia in front of adoption and integration of digital technologies.

Results indicate that, although there is an appropriate adoption of digital technologies, (100% of large companies, 98% of pymes and 94% of micro-business, use Internet); most of the times the use of technologies is limited to communications between offices of the company, and there is very little contribution received for the improvement of productive processes of companies and organizations. Then, an interesting paradox arises that seems to permeate all companies or organizations in Latin-America: We got digitalized! And now what?

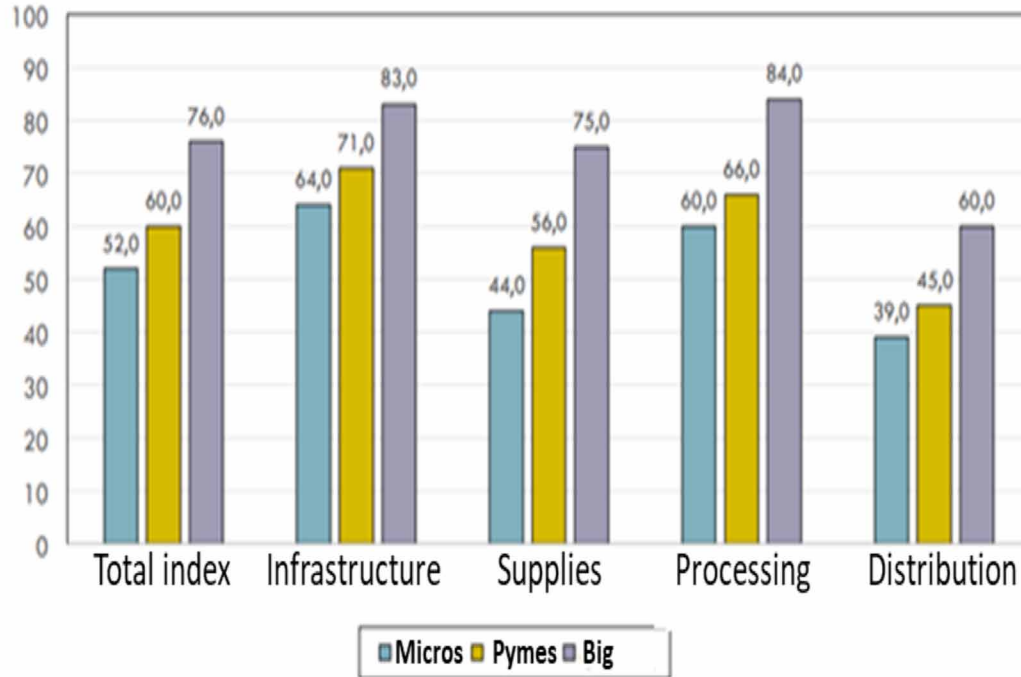
This is precisely a much more interesting challenge, for the development of the new business conception and strategic management, and that is how to add value to products and services from the digitization, as opening of new markets where transactions are faster, and where physical cash is not the excellent means of exchange.

Organizations in Colombia and their CEOs are faced to competitive scenarios every time more demanding, where paradigms of large capital holdings are put in a second place, at least with respect to the phases of company incubation. It is there where specific competences are approached by the CEO, in Colombia and in general in countries of emerging economies, linked to the ability to promote ideas, in a world every time more inter-connected and more inter-related, where needs of one are the opportunities for others, and where the role of suppliers and consumers are easily interchangeable, to small and medium commercial scales. A clear example of these continuous mutations are the cases of small transporters motorists, pedicabs, services as UBER, Rappi, buyers and platform suppliers as free market and other similar activities.

CEO in Colombia should be prepared for non-frontier competence, where the market laws are no longer dictated by governments, but by trends which are variable with respect to likes and specific needs of customers, as well as of suppliers. With products and services that continuously get revalued, and which at any moment may lose their value, as a fundamental reason for transaction, such as it is for example the voice services in telephony, where it happened to be the main service offered to users, and

Figure 16. Colombia: Index of adoption of mature technologies per stage of the value chain (0-100) (2017)

Source: Adapted from: https://www.mintic.gov.co/portal/604/articles-61929_recurso_1.png



now is one more addition or component within the integral package of services sold, through which telecommunication market transactions are done, not only in Colombia but in the whole world.

General Competences of a CEO: Between Objectivity of a Position and Subjectivity of Each Leader

Consensus on competences of a CEO results difficult of establishing with respect to complexity of organizations, and their problems. Review of specialized work on the topic, provides clues and approaches on some of those complex skills that a CEO should have, even indicating a classification of the management competences about:

- Strategic, those related to their management abilities
- Intrategic, which defines their leadership ability inside the company or organization, and
- Personal efficiency, focused on his relationship with the environment and his personal and professional development.

For each one of these classes of competences, characteristics are established which try to set up a target floor on the competences assessment for a CEO (Flores & Vanoni, 2016). Table 6 shows a summary of them.

Trends in Management of TI Projects and CEO Competence

In fact, this classification of competences is not the only one, and other criteria for classification can be seen, and some common characteristics for each way of organizing competences of CEOs. On table 7, authors such as (Palaima & Skarzauskiene, 2010) consider competences linked to emotional and social intelligence, the most relevant, since by themselves they are linked to human development of CEOs, meanwhile cognitive intelligence is linked to their development with the organization.

The way these competences are interrelated, and how they project the company in its continuous development, for a better performance, is evident in the following table (figure 17).

As it can be seen the way the competences of a CEO are interrelated, are a key factor for the organizational development, and they rule the future course of the company in different performance situations.

Other perspectives around competences associated to leadership, which a CEO must have, are among others, the following qualities: Integrity and confidence, orientation to obtain results, importance on actions, perseverance, effective use of time, communication, formation of high performance work teams, decision making, negotiating capacity and strategic management capacity. (Páez, Maldonado & Murillo, 2004) (Páez et al., 2012).

Figure 18 shows the leadership competences for a CEO according to perspective of a transformational leadership.

Table 6. Management competences of a CEO

Management competences of a CEO	Main objective	Details of competence
Strategic	Economical results	Perspective of business and the organization. Inter-functional orientation Resources management Bargaining power.
Intrategic	Commitment with employees and other collaborators from the company	Assertive communication with dependencies Adequate treatment with people Know how to delegate Teamwork Leadership
Personal efficiency	Relationship towards oneself and his environment	Be proactive Have the ability to solve problems and conflicts. Ability for self-management Personal integrity Be a professional in continuous development.

Sources: Adapted from (Flores & Vanoni, 2016) and (Bandiera, Bandiera, & Hansen, 2010.)

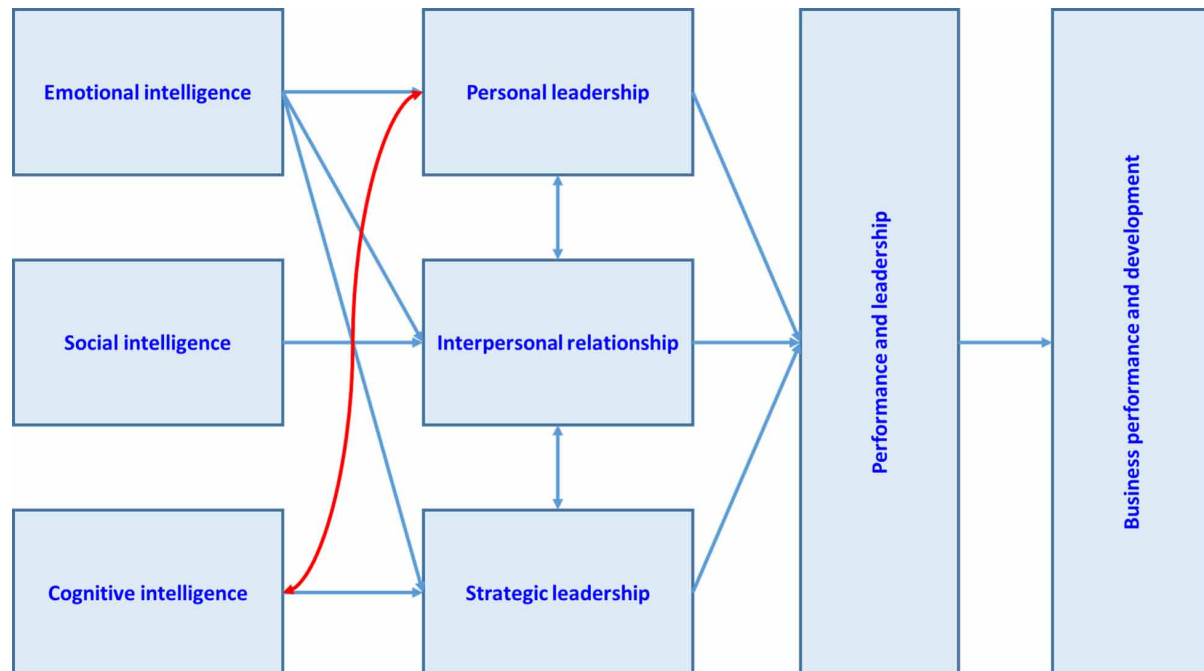
Table 7. Intelligent competences of a CEO

Competence	Details and Remarks
Emotional intelligence	They are focused on self-knowledge, management and self-control in front of pressing and stressing situations. The management of optimism and its flexibility in the face of adversity.
Social intelligence	How much confidence inspires his leadership, how good he is as a counselor towards change, and how does he manage conflicts? How assertive and coherent he is in communications?
Cognitive intelligence	He handles interdisciplinarity in decision making. He is open to handle new models and comprehension of problems. He has a dynamic thought and he is favor of continuous learning

Source: Adapted from (Vilkinas, 2015) and (Pless & Maak, 2010)

Figure 17. Competences interrelation

Source: Adapted from (Palaima & Skarzauskiene, 2010)



Integrity and confidence identify the way the leader acts, how authentic, correct and honest he is. Orientation for the obtaining of results, is more related to his ability and efficiency to execute the company or organization's mission, that is to say – set its north. In the case of a CEO it stands out that he seeks in an adequate manner, to conjugate the obtaining results with the orientation towards good relationships with all levels of the company. (Blake & Mouton, 1982).

Trends in the Management of TI Projects and the CEO's Competences

The future development perspectives with respect to projects management, is based on a joint growth of leadership heads, as well as from work teams and the organizations together. Some authors say that leadership in the organizations face new scenarios, linked to emergence of new strategic-type functions such as: the establishing of strategic interpersonal alliances, with defined groups of potential collaborators or cohorts, design of plans in favor of obtaining beneficial results for all collaborators, the organization of different alliance members to integrate the action teams, and the implementation of action plans with clear and measurable objectives, but with the flexibility of adaptation to unforeseen events. Briefly, this first trend is focused on a joint development of organizations, and their leaders with a high level of adaptability in the face of changing project conditions (Graen, 2016).

A particular trend is found in the fact of a marked development bias of companies and their CEOs towards the attention of social responsibilities, which is explainable at first instance, due to the coming of social, economic, political and environmental challenges, from the financial crisis on, which have a greater global impact. Thanks to globalization. The discontent and dissatisfaction of society, in the face of the position of rulers and the political class in general, in the different countries, has allowed

Figure 18. CEO's competences from the perspective of transformational leadership
 Source: adapted from (Cardozo, 2018).



that a particular phenomenon of translating responsibilities towards the private sector, and the business organizations are now an object of greater reliability for people than government. From there, business organizations and therefore their leaders, are seen as champions of respect for a healthier environment and better for all mankind, and for responsible people to guarantee sustainable conditions for social and cultural development for communities impacted directly or indirectly (Fernández, 2018). It is paradoxical, but verifiable the fact that actually people trust less in political institutions, and greater expectations for an advantageous future in the business leaders and the organizations they represent.

The successful cases of this type of trends, are evident in examples as Coca-Cola Company, which leads campaigns linked to conservation of environment (Coca-Cola, 2014). In that campaign, it is shown for example, how in order to reach a more efficient use of water, strategies for technological development have been approached that allowed decreasing of water consumption, used for production on year 2014, about 32% compared with amount of water used on 2002. The socialization and awareness campaign about the reutilization of packaging, and even the adoption of a personal bottle, is another example of the impact every time more significant, that large companies have, about the social behavior of communities, and justify the trend of responsibility of organizations and their leaders, who fill the space that the government fails to fill.

For (Church & Burke, 2017) there are four clear trends for the future development of organizations and companies, and they are linked to: Prevailing of platforms about products, from digital to mechanical or analogical, the importance of talent over employees, or better defined as the frames comprising a position as such, and the importance of perception on collection and strict analysis of data. All this is based on actual development pillars of modernity in the organizations, such as the change on the way of

getting things done, management, processing and analysis of a BIG DATA and transition of individual leadership to establishing of work teams, (Figure 19).

Regarding the trend to move from platforms to products, it must be said that organizations should get specialized every time more, in establishing products tailored to their customers, with versatility in their management referring to maintenance, after sales parameters of quality and services. Every time more companies interact with their customers through spaces in internet, even offering spaces for interchange of opinions with other customers, possibilities for product interchange with other customers, and manufacture of consumer items made to measure. The customer now, no longer buys a product but a trend of products, such is the case of cellular telephony, with its accessories and complements, besides the information packages. In this sense, organizations should be oriented every time more, towards policies and strategies of customer loyalty, making of their products and services a life way and style for their consumers (buyers).

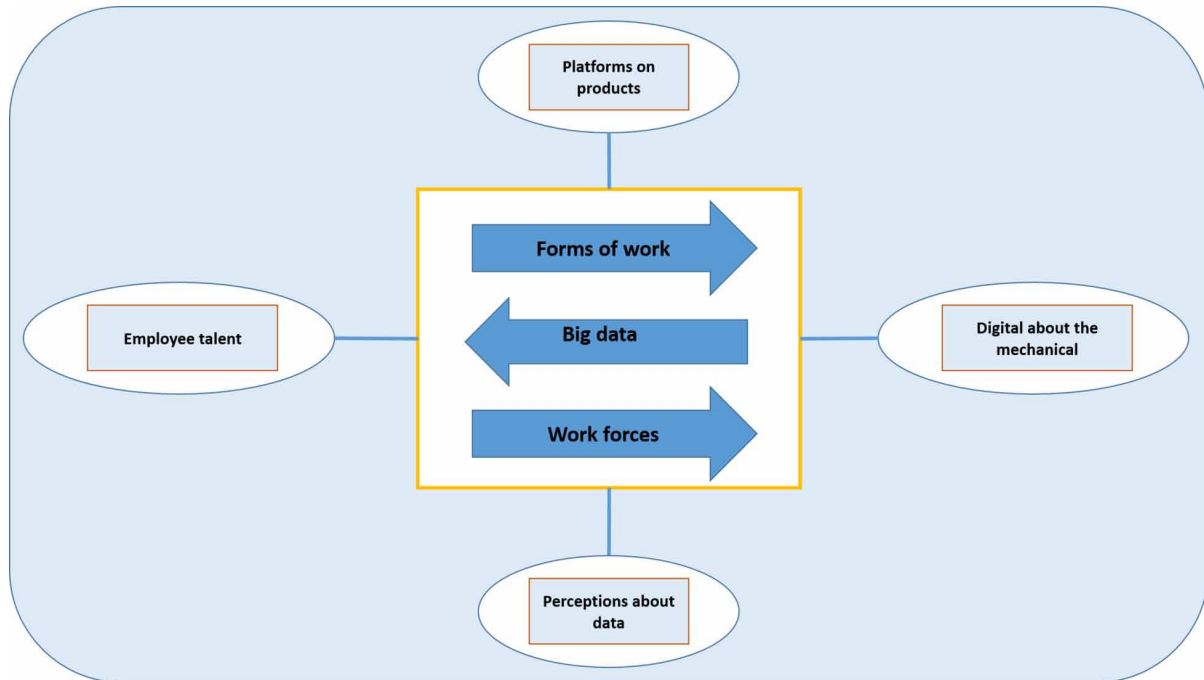
The change from the mechanical to the digital is a trend that prevails, and as stated in (Finanzas & Desarrollo, 2018) “digital technology will continue expanding, and the efforts to ignore it, or regulate it against itself,”. And now we are not only experimenting the migration towards the sale of products and services purely digital, such as data packages, membership to channels and web portals and television, but also the incursion every time bigger, for digital payment, and existence of digital currency as an element of free interchange primarily on the field of services. This fact shows that companies and organizations, as well as their leaders, must focus their efforts to the establishing of value chains, about what was once considered intangible, as approached by commerce in the sale of software applications, and in general digital services. The CEOs of now, must be prepared for a new sphere of transactions of a new invoice based on the Blockchain for sales and general marketing.

A Blockchain is a database distributed between different participants, protected cryptographically, and organized in transactions blocks, related to each other mathematically, and it is not easily falsifiable. An important element is that it allows the establishing consensus between different actors, about the existence, state and evolution of a series of factors, shared by all those involved in a business (Kuchkovsky, Gómez, Diez, & Molero, 2017). From a technical point of view, that system based on confidence and consensus, is built from a global network of computers that handle a giant database. This grand database may be open completely, for the intervention of any agent or customer who wishes to intervene, case in which the denomination of “Public Blockchain”, is given. Or it may remain closed for only some interested parties, in the transactions, as it happens with banking schemes or stock exchange, configuring thus: “Private-type Blockchain”. A commercial transactions system where customers and service suppliers, and products interact without external measurements from the bank or from governments. Offer an exciting panorama, and care regarding the challenges that existent companies should face, and the ones that will get consolidated in the future.

The trend that talent prevails with employees is focused to encourage the empowerment of collaborators, beyond of what the limits and their own functionalities demand it. To promote personal and professional growth of employees and collaborators, understanding that the organizations growth should be closely linked to the one of people who make up the company, and it is there where real success lies, when organizational success becomes the collective's goals and not only of their leaders. At this point it should be taken into account that a good number of organizations, have followed processes for the design and execution of selection and promotion plans, where employees and collaborators of the company evaluate themselves, and help to redefine the action fields, and therefore, tasks they can perform, as well as required times and resources for each one of those actions. The CEO are now faced

Figure 19. Trends for future development of companies

Source: Adapted from (Church & Burke, 2017)



with integral management more than people from functional units, participating, proactive and who no longer have a passive role, and they went on to become driving engines for the improvement of the company. (A. Church & Burke, 2017), (Fernández, 2018). In the new organizational contexts, for the new generations of collaborators from millennials, the reception of positive comments about their labour, is in great measure motivating, and the real possibility to build a successful career in their organization (A. H. Church & Rotolo, 2013).

The last trend approached is the priority that perception should have about data and its analysis, which is a scope towards valuation of the institution, being this a time where ideas and innovation are the main router of potential for the company. In fact, the combination of digital transformation and the need to generate from the management of large amount of data, generated, merge with the phenomenon of Big Data (A. H. Church, 2018) (Rotolo & Church, 2015).

Big Data is a worldwide trend with a great growth projection of the market involving it, and the related research areas. The term Big Data is frequently associated to exorbitant amount of data, but it should be understood that not only the large size, but diversity of data should be taken into account, and the access and processing speed of it. The actual marketing scenarios require that you go from transaction to interaction, allowing to make the most of information obtained (Rotolo & Church, 2015) (Hernandez, Duque, & Moreno, 2017).

SOLUTIONS AND RECOMMENDATIONS

About the importance given to the action of a CEO, the tasks execution should be projected in such a way that they have to be carried without considering who does it, and regardless of whatever monitoring or continued supervision. To be persistent for a CEO, must be his imprint and be fixed in his AND, since he must keep firm in the achievement of purposes, objectives and goals, overcoming barriers and facing difficulties.

A CEO plans in such a way that an effective use of time is made, establishing a balance between the periods to think on the organizational and individual development of each collaborator, and of the CEO himself. For this, an assertive communication is vital between all departments or units of the company, and it is the CEO who should promote that these communication links are established, with the aim of making everybody to understand the organization's feeling.

The conformation of high-performance teams grants the CEO and the organization, to have a support and solid basis for their development. It is reminded that there will be lots of occasions in which a CEO must delegate functions or specific tasks, and a back-up team is important during these eventualities.

Decision making, as well as negotiating ability and strategic management, belong to the type of qualities and competences that a CEO assumes under his direct responsibility, and which make him the total performance manager of the company. Here, the good sense should prevail, and understand that within the premises, a continuous analysis and evaluation of situations must be present, in order to minimize risks, and to persuade others within an ethical framework, to reach agreements and consensus. Finally, whenever necessary, learn how to change the course with respect to goals and objectives of the company, interpreting coming changes and trends.

Talking about recommendations and suggestions, CEOs are proposed, and in general to organizations, to count with units doing technological surveillance around the trends in the companies' management, the emergence of new marketing spaces, and new strategies and alternatives to open business, in favour of strengthening the value chain of the company. Some authors such as (Kim & Mauborgne, 2005) are inclined to look for Blue Oceans, where competence, if it exists, be unimportant, since novelty of the product or service, should not produce an immediate reaction of potential competitors. However, it is wise to keep in mind that organizations should be prepared for their development and the daily chore, the stages of apparent calm alternate with the ones of great turbulence, when the market in general reaches maturation levels, to place it at par until what some time ago seemed innovating.

The fundamental thesis in the blue ocean strategies, lies on the need to leave aside the destructive competence between companies, if you want to be a winner in the future. This scenario approaches the continuous rediscovering of market niche and the search of unexplored horizons, from the hand of an innovator, unwavering and tireless spirit. The blue oceans are characterized by the creation of markets in areas which are not actually exploited, and which generate opportunities for a profitable and long-term sustainable growth, contrary to the "red oceans" with rules already established, and with natural limitations linked to the defense of status, or dominant positions of those who have managed the markets in their beginnings (Kim & Mauborgne, 2005).

An important bet of CEOs and their organizations should be done towards the vision of shared business, with users where they can emerge as active agents of the market, on the decision making, such is the case of the energetic service market, where provision of energy is the reason to be of companies, but the development of new technologies, of distributed generation, supported on renewables, has allowed that users go on to become pro-users, that is to say market agents that in a moment they go from being

net consumers, to occasional generators of energy (Menniti, Burgio, Pinnarelli, Brusco, & Sorrentino, 2013). It is precisely this understanding of a new type of commercial relationships, where users make decisions, not only about rates and quality of service, but also about their suppliers, and the way how they can be integral part markets, what the new organizations should consider in their management processes.

FUTURE RESEARCH DIRECTIONS

The research lines that little by little become trends for organizations and research groups, focused on the business and organizational development, take as fundamental pillars the change dynamics, as far as competence between work teams is concerned, dedicated to management, giving priority to improvement of the management positions and decision, focused on skills such as adjustment and control of changes in fluctuating scenarios, more than aspects related to academic formation, in the strict sense of the word.

The emergence of companies completely digital, where merchandizing and money management is done exclusively through the network, should be taken as a first order trend for future research about business development. Phenomena as the emergence of Bitcoin (Nakamoto, 2018) explain the overvaluation that capital goods had, since actives are no longer a fundamental piece in the value of an organization, and its transactional ability prevails. Research should be then focused towards the development of a society where the idea of money as conceived at the moment, is expected to disappear, where real value of things is defined by its acceptance and exchange capacity in the markets. The emergence of a new type of market, where transactions are closer between suppliers and customers, where although, intermediation can be maintained, it is expected to become a less important role, meaning that it may be a free-choice role, or even designed in accordance with the volume of transactions desired to be established, as the case of Blockchain's systems that manage platforms as PAYPAL.

Organizations must bet on the search for niches of markets, where potential customers feel part of the processes and help on decision making on the required change of products and services. That is how joint worktables in companies where developers, suppliers of goods and customers, have a meeting point and become a useful tool for the development of existent products and services, and those ones to launched in the future. Examples as travel agencies and internet portals that offer vacation packages, are a clear evidence of how joint work of service suppliers, together with customers opinions, may allow the building of better solutions which at the end of the day provide benefits to everybody involved in such solutions.

Potentiality of small and medium enterprises (Pyme) constitutes without doubt, a topic that requires special attention, since commercial frontiers are every time more intelligible, and less firm and strict, thanks to the technological basis, which generate dynamic processes of profile change, and magnitude of "small companies" towards organizations formally consolidated. Descriptions linked in the past to the number of employees, management of influence zones or economical capital to define a particular type of company, have been clearly objected nowadays. The process of companies as Amazon, eBay, Rappi, Uber, are clear examples that limits for companies do not exist, and that the power of ideas goes beyond knowledge or of the money management, or the existence of actives formally said.

Research on business development should then, focus on the new types of commercial relationships between customers and suppliers, understanding that frontiers between them, may or may not be present on many occasions, and that roles may be easily modified when scenarios of opportunity costs are configured out, for services as transport, energetic and replacement products. (Arenas, 2014).

CONCLUSION

Concepts related to TI project planning, spoke about the importance of establishing an approach towards the analysis of success critical factors, strategic decision making, study of strategies for knowledge transfer, as well as the special emphasis on the analysis of planning strategies, oriented to risk mitigation and decision making in projects.

In the same way, results shown on the co-relation map associated to the concept of management, conclude that, within the main topics related to the TI project management, there is the risk management, the innovation management, the knowledge management, the interested parties' management, and finally, the study of leadership roles for the management of project teams, that generate results of positive transformation in the contexts where they are developed.

Therefore, management, management and TI processes in the companies or organizations, require a CEO with a high degree of emotional intelligence (EI), Social Intelligence (SI) and Cognitive Intelligence (CI), fundamental competences to reach the success of strategic organizational objectives, sustain the decision making, take advantage of technological resources, appropriation, the effective and safe use of troubleshooting or needs.

Their leadership ability, qualities or aptitudes and their competences and skills, and technical-practical domain, can be potentialized through the management of Emotional Intelligence, Social Intelligence and Cognitive Intelligence. That is why from the strategic, management and operational level, the CEO can face the challenges with self-control, self-knowledge, and solve conflicts arguing from different points of view, with the purpose of understanding that management and TI processes is an activity specifically human, constant throughout world history, where reality is explained and glimpsed.

Therefore, facing challenges, is not easy but if his competences are articulated as a leader, he can inspire his collaborators to transcend, from his individual interests towards common and collective goals, managed from the (EI),(SI) and (CI) to energize and project the organization, identify potential risks to which the company could face, and prepare it to overcome any unforeseen situation, encouraging his employees and collaborators, but at the same time, with the ability to motivate himself, and persist in the processes requiring a permanent and systematic flow, complying with attributes of quality, opportunity, continuity, reliability and integrity, so that he guarantees the management of operative, tactical and strategic levels, as well as his technical knowledge, in order to add value to business in the organization, towards production of new knowledge.

Also, it is relevant to associate to competences of Intelligence, Emotional (EI), Social Intelligence (SI), and Cognitive Intelligence (CI), integrity and confidence, orientation to obtaining results.

In a certain way, the CEO's competences should be focused on the different inter-actions within his surrounding environment, to propose solution alternatives, knowing how to do the correct thing in concrete situations, requiring the creative, flexible and responsible application of knowledge, skills and attitudes.

Markets change and, the organizations as well as their leaders must change, and be up to the challenges imposed by society and which it is expected to be satisfied as a need. Organizations must understand that they need not only to take an introspective look of what they are, from their human and technical resources, but also, understand that an important part of the company are its customers, but now not only from the vision of target population, but also as change agents and energizers of market with a role every time more active within the value chain of organizations.

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KEY TERMS AND DEFINITIONS

Adaptability: Flexibility in the face of challenges or obstacles.

Blockchain: Blockchain for transactions without intermediaries.

Collective Intelligence: Intelligence that arises from the collaboration of many individuals

Data Mining: Process to detect information from large data sets, in the most automatically possible way.

Emotional Intelligence: The ability to properly manage emotions, both their own and others.

Flexibility: Ability to adapt easily to different circumstances or to accommodate standards to different situations or needs.

Gamification: Learning technique that moves the mechanics of games to the educational-professional field in order to achieve better results.

Project Planning: Effective system of construction project management that allows defining the objective, scope and strategy to execute technical, economic, financial and socially viable works.

Project Management: Set of methodologies to plan and direct the processes of a project.

Publication Dynamics: The way in which the issuance of scientific articles on some subject is given.

Search Equation: Combination of keywords and operators to express a need for information.

Social Intelligence: A person's ability to understand, treat and get along with the people around him.

Stakeholders: Collaborators, suppliers and eventual partners that a company may have.

Technological Surveillance: Organized, selective and permanent process of capturing information from outside and from the organization itself on science and technology.

Transformational Leadership: Leadership style that is defined as a leadership that creates a valuable and positive change in followers.

Chapter 3

Team Conflict Management in Project Management in Colombia

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ABSTRACT

This article examines team conflict in project management. A study of the current literature, the focus of the bodies of knowledge and the perspective of managers in Colombia is presented. Information is collected through a questionnaire about the impact of sources, types of conflicts, dispute resolution mechanisms and progress reports on the final performance of projects carried out recently by the interviewees. The importance of conflict resolution has been validated as a success factor in the management and performance of projects. The chapter aims to increase researcher interest in the subject, as well as to encourage the development and implementation of methodological tools, in order to achieve better results in the implementation and success of projects.

INTRODUCTION

Managing a project is, almost by definition, managing conflicts. (Graham, 2007)

In a project management process, several factors that can influence and determine the level of performance at the end are taken into account. These factors must be managed efficiently for the entire project life cycle in order to increase the chances of meeting the targets. There is extensive research in the area of

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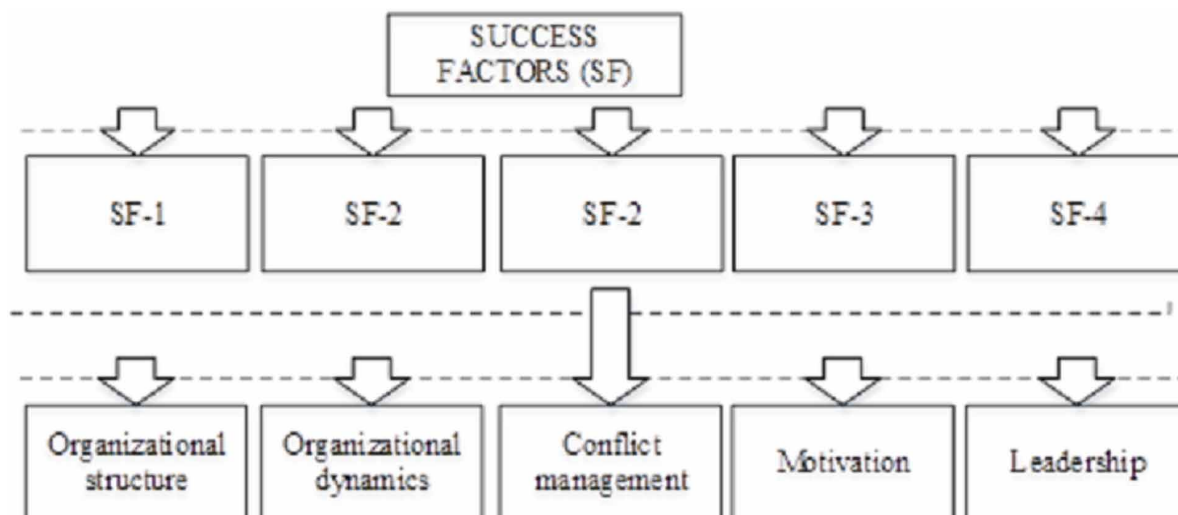
“Project Management” that analyses success factors when implementing a project (Agarwal and Rathod, 2006, Cooke-Davies, 2002; Hyvari, 2006, Kendra and Taplin, 2004, Pinto 1990, Pinto and Slevin, 1988; Shenhar, Levy and Dvir, 1997; Toor and Ogunlana, 2010). There is a consensus on the priority to control those factors that enable an effective completion, meeting all performance parameters.

Within the success factors of a project, human capital emerges as an inevitable component in the managers’ agenda (Brown, Adams and Amjad, 2007, Cooke-Davies, 2002; Pant and Baroudi, 2008). Along the same line, Alam et al. (2010) have explored the importance of human skills to manage projects, noting that this factor can make a difference in their performance. The relevance of these skills has been widely recognized (Pant and Baroudi, 2008), to the point that they are outlined as a research perspective within the categories of future scientific knowledge of Project Management (Kwak and Anbari, 2009). The management of human capital as a success factor can be divided into a set of sub-factors, which must be monitored in the project life cycle to effectively carry out its management. According to Kwak and Anbari (2009), human resources management is identified as a research trend of project management. Part of this would be the aspects related to organizational structure, organizational dynamics, motivation, leadership and conflict management, as shown in Figure 1.

Within the mentioned sub-factors, the last issue is often given little importance: “Conflict Management”, but that can mean the difference between success and failure. Human capital is indeed a crucial success factor in project management, and conflict management is an essential aspect within the set of sub-factors shown in Figure 1.

According to Diez-Silva et al (2011), conflicts appear as one of the sub-factor categories to be measured in order to perform monitoring of project management. Likewise, conflicts are evaluation criteria and represent a success factor of the implementation process (Jha and Iyer, 2007; Toor and Ogunlana, 2010). In other studies problem solving or conflict management is one of the measures that determine performance (Cheung, Cheung and Suen, 2004, Fortune et al., 2011th, Yuan et al., 2011). It is considered that the study of conflict management in project teams and its relationship with performance is consistent with the current and future perspective of the project management’s discipline.

Figure 1. Human capital as a success factor and its sub-factors



Conflict is a typical human manifestation. Due to the ability to think, relate and interact, individuals make their nature to be conflictive. It can be defined as a process in which one party perceives that his interests are being affected negatively, against, by the other party (Wall Jr and Callister, 1995). In organizational and project contexts, consisting of people, conflict is originated in daily activities, relationships between members, work activities, or internal processes. Muñoz (2004) refers to the research on the subject as a matter coming a long way, as for decades there has been concern about conflict as a way to explain human problems. Due to this concern the concept of conflict management has been designed; thus, it has been progressively more useful in explaining group and social phenomena, among others.

The literature suggests that studies of conflict management have earned a reputation as a legitimate academic field, which consists of four different sub-fields (Ma, Lee and Yu, 2008), such as “team conflict and performance, sources of conflict, conflict resolution methods and negotiation”. It also has been documented that teamwork has benefits, but in turn, can be a source of conflict that impairs the efficiency and performance of the team (Han and Harms, 2010; Jehn and Mannix, 2001). The interpersonal context of teams makes the conflict arise, which can affect performance (Chiocchio et al., 2011). Therefore, conflict in the implementation process of a project is very likely, almost inevitable; since it involves different individuals that, together, must temporarily undertake activities to complete a more complex task.

The research analyzes and describes the current status of the topic under study, including journal literature, standards and Bodies of Knowledge. An empirical study is carried out to understand the project managers’ perspective in Colombia. The purpose of the empirical phase is to characterize the sources and types of conflicts most common in the projects, as well as the usual resolution techniques, by reference to the categories extracted from the literature. In addition, with the results of this phase, the impact of the characterizations on the performance of the projects reported is analyzed.

This chapter aims to provide a contextual framework for the conceptualization of conflict and its management in project management contexts, developed from the Bodies of Knowledge and literature. Also, it is intended to analyze the relationship between sources, types and mechanisms of conflict resolution in teams, setting the variables that affect both positively and negatively the results of the projects. It is expected to contribute alongside professionals, towards developing tools to improve project performance by dealing with conflict.

This chapter is structured in six sections. In the first section related to conflict management in different contexts and countries work are described. In the second section the inclusion of conflict management within the different bodies of knowledge of project management is illustrated and proposed strategies are identified to manage conflict through the project life cycle. The third section shows the methodology used for this study, the target population identifies and describes the techniques and instruments for collection of information related to the sources and types of conflict as well as resolution mechanisms employed in the management of projects in Colombia. In the fourth section the results are analyzed, showing a demographic description of the sample first and then the most relevant results in relation to types, frequency, duration and sources of conflict and the conflict resolution mechanisms used by project managers. Finally in the last two sections the conclusions of the study are presented and future lines of research related to the object of this research is recommended.

BACKGROUND

In order to contextualize the study performed, this section includes a description of work related to the management of conflict generated within project teams conducted in different countries. Teams are groups of people who meet to carry out a concrete job, whose life cycle begins and ends with the initiation and completion of tasks that meet the target (Gersick, 1988). In the area of project management, the concept of team has been defined in many ways, but a generalized definition is the group of people with complementary skills committed to a common purpose, performance goals and defined responsibilities (Eskerod and Blichfeldt, 2005). According to Eskerod and Blichfeldt, a particular feature of a project is that its tasks must be completed by a temporary team with members who may be very different and whose degree of cohesion differ them from a simple workgroup.

Team conflict is not always negative; as long as it is moderate it can bring a positive impact on many aspects that can be used to improve performance (Behfar et al., 2008). But in many cases, conflict can have a strong negative effect on team performance in complex tasks (De Dreu and Weingart, 2003). In project teams, the temporary nature determines that time is crucial; therefore, it is essential to determine the effects of conflict because the consequences of mismanaging it can be irreparable for the project's outcome, people involved and their interests.

Research in project teams has identified that intra-group conflicts may have different types, but the concept is very similar (Chen and Chang, 2005). A common classification is conflict of tasks, relationships and processes (Behfar et al., 2008, Jehn and Mannix, 2001). Task conflict applies to the differences between points of view, ideas and opinions about a group task; while relationship conflict refers to differences due to personal incompatibilities, including affective components, tension, friction, aversion feelings, anger, frustration and irritation (Jehn and Mannix, 2001). Task conflicts can be generated by the distribution of resources, procedures and policies, judgments and interpretation of the facts; whereas relationship conflicts, by personal taste, political preferences, values and interpersonal style (De Dreu and Weingart, 2003.)

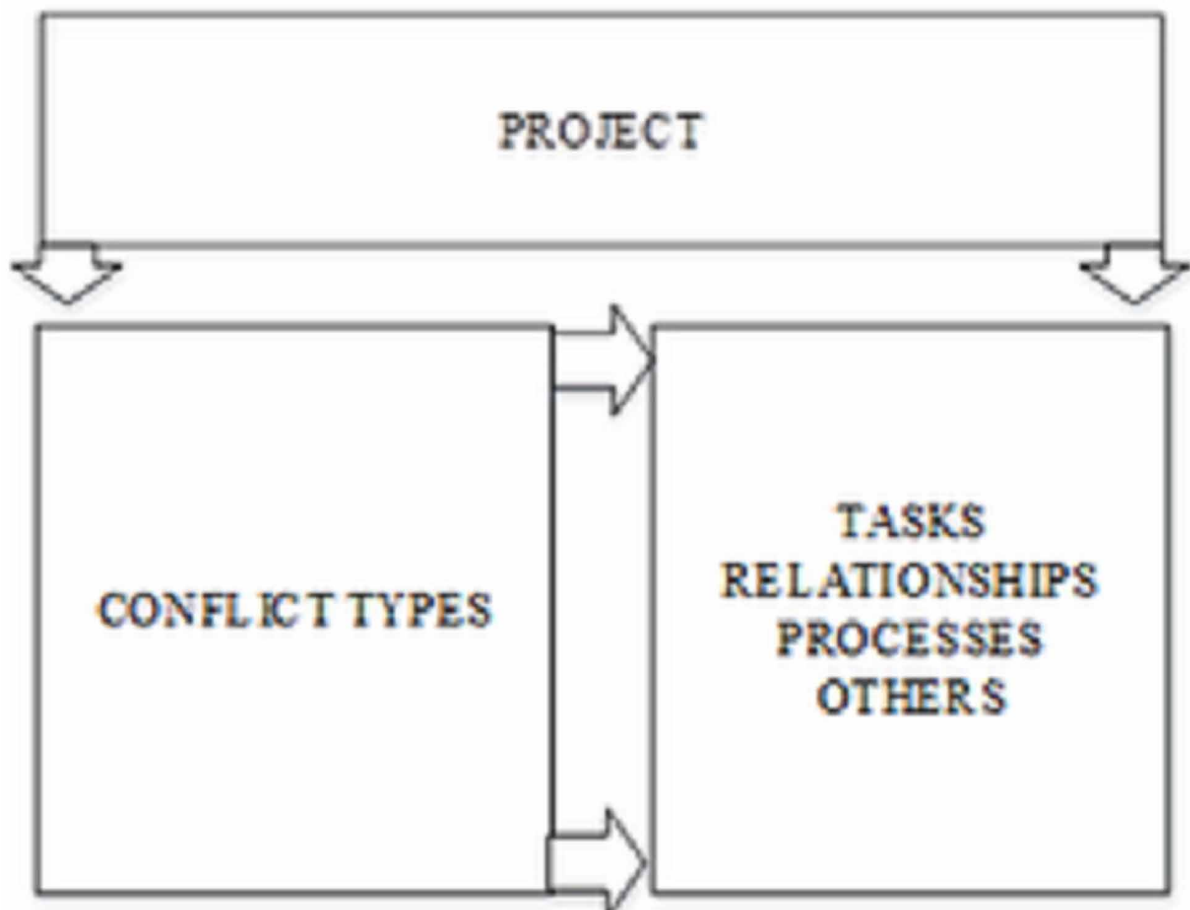
There have been several studies related to task and relationship conflict (Bisseling and Sobral, 2011, Chen and Chang, 2005; Han and Harms, 2010; Jehn, 1994, 1995, 1997, Lu, Zhou and Leung, 2011). It can be said that these two types are the most common in the literature on intra-group conflicts. The third type "process conflict" is less frequent than the two mentioned above, has recently emerged in research, and has been incorporated as a separate part of task conflict (Jehn and Bendersky, 2003, Jehn and Mannix, 2001). Process conflict is generated by differences related to the resources to finish the tasks, for example, the composition of the team and allocating who should do what, the debate about resources and the discussion on how to schedule tasks efficiently (Jehn and Bendersky, 2003).

Some studies in the area recognize the above classification and rephrase it in a project context. Mele (2011), for example, describes the most common types of conflict in each of the project management's phases. It is established that the planning process shows the conflict of roles, values and tasks, and the implementation process shows the conflict of tasks, processes and emotions. Meanwhile, Han and Harms (2010) transfer the organizational conflict to the project context, identifying task conflict and relationship conflict as being usual, as well as influential on the confidence of the members. Others have examined the role of task and interpersonal conflict on the project team (Chen and Chang, 2005), defined as groups of people working outside the lines of authority, on a temporary basis (Porter & Lilly, 1996). Figure 2 shows an interpretation of types of conflict that can arise in projects.

It is considered that the above characterization is consistent and transferable to project contexts, topic under study, which essentially has a marked influence of process management. To validate the above, the existing Project Management literature is analyzed, which recognizes the benefits of implementing methodologies, which are often adapted standards and processes, such as PMI and PRINCE2 (McHugh and Hogan, 2011). Therefore, the literature related to the study of conflicts is analyzed, specifically about projects, as well as the techniques and tools most used for the management of conflicts in teams.

For dispute management in teams there are many alternative methods, such as negotiation and mediation, among others (Yousefi, Hipel and Hegazy, 2010a, 2010b). Likewise, there are styles of behaviour to deal with conflicts, one of which may be more appropriate than the other, depending on the situation (Lee, 2008). Researchers in social psychology and organizational behaviour have proposed many different styles of conflict management and measurement tools to detect the style used by each individual (Blake and Mouton, 1964; Rahim, 1983, Thomas and Kilmann, 1974), and these have been used in several studies (Lee, 2008; Randeree and Faramawy, 2011, Shih and Susanto, 2010, Thomas, Thomas and Schaubhut, 2008). For example, for Thomas & Kilmann (1974) styles of conflict management are: collaborative, commitment, accommodating, competitive and evasive.

Figure 2. Conflict types in project management



Project management's literature recognizes that conflict is no different from the contributions on areas of organization, because the team is in fact an administrative structure (Butler, 1973). According to Kerzner (2009), a project manager is a "conflict manager"; and the sources of conflict can be human resources, equipment and facilities, capital outlay, costs, technical opinions, priorities, administrative procedures, agenda, responsibilities and personality clashes. Kerzner characterizes the styles of conflict resolution that a manager can take adopting Thomas & Kilmann's classification (1974); and recognizes that this may be intra-group, between the project manager and human resources, between the manager and her/his superiors, or between the manager and the functional departments.

A study conducted in Australia, Canada and the United Kingdom in 2002, endorsed in 2011, analyzes the experiences of those involved in the area of project management on various issues (Fortune et al., 2011b, White and Fortune, 2002). In this research, one of the critical success factors in project performance is related to the effective leadership and conflict resolution. Thus, conflict management in project teams is recognized as a relevant subject for the discipline. However, no evidence was found to help analyze which of the methodologies, techniques or tools provides a specific procedure for the team to resolve conflicts effectively.

Conflict associated with project management has also been classified in some cases with two approaches: conflict related to change and conflict related to the concentration of professionals from different disciplines in a group effort with a limited life (Butler, 1973). On the other hand, it has been shown that another common type of conflict in project teams is personality, being evident in the life cycle stages (Hill, 1977). This type is considered favourable if properly managed, and might generate benefits such as improved self-esteem, morale, and communication. However, conflict can be very damaging if not treated effectively by understanding its dynamics and by learning approaches for its resolution (Ohlendorf, 2001). The present study takes the conflict classification above mentioned: tasks, relationships and processes.

It was also found the need for conflict measurement to complement the traditional indicators for evaluating success in a project, proposing dispute metrics as a parameter to detect improvements in performance (and Ogunlana Toor, 2010). Others, like Sohail & Baldwin assess the performance of small projects in developed countries. However, while acknowledging the importance of these contributions, it is considered that the indicators can detect the conflict, but should be integrated with other prevention and resolution methods or tools, once this has been manifested.

Along the same line, researchers have proposed some classifications and types for the sources of conflict, specifically for the area of project management. Kerzner (2000, 2009), states that the most common conflicts in the implementation stage are generated by: labour, equipment, expenses and costs, technical opinions, priorities, administrative procedures, schedule, responsibilities, and personality clashes. Other authors have proposed similar classifications, stating that the sources of conflict are due to: agenda, administrative procedures, communication, setting goals and priorities, resource allocation, performance assessment, interpersonal relationships, costs, technical opinions, policies, leadership, roles/ambiguous structure, and priorities for resolving disputes (Cheung and Chuah, 1999, Singh and Johnson, 1998; Thamhain and Wileman, 1977).

Professional associations such as the Project Management Institute (PMI) have discussed, in some events, the types of conflict sources in projects, reporting the following: agenda, cost and budget, priorities, human resources, technical problems, personalities and administrative procedures. Other similar types conceptualize the sources of conflict with the following classification: priorities, administrative procedures, technical advice, human resources, costs and budget, agenda and personality (Verma, 1998).

In the above classifications, one can see a consensus on determining the sources of conflict. There are other classifications too (Jones and Deckro, 1993; Mele, 2011; Randeree and Faramawy, 2011). The types highlighted above will be used in the design and implementation of the questionnaire whose results are shown in further sections.

On the other hand, conflict management also involves the design of effective strategies to reduce them and constructively improve towards learning and effectiveness (Randeree and Faramawy, 2011). On that basis it is considered important for the study to include, as a preliminary step, contributions of the literature regarding methods of conflict management or analysis of its impact on project performance. Along this line, methodologies have been proposed to deal with disputes that arise in projects, or conflict management models (Yousefi et al., 2010a, 2010b), which also show a positive relationship on project success (Robey Smith and Vijayasathya, 1993).

Other studies characterize the most popular methods for resolving disputes on construction projects (Chan and Suen 2005); review some methods for resolving conflicts (Harmon, 2003); propose strategies for managing conflict in teams (Van Slyke, 2000), which is interesting as a good standard practice; and present a graphical method to solve conflicts (Al-Tabtabai, and Abou-alfotouh Alez, 2001). From the review of the literature it is concluded that the management of conflicts is a subject that is rarely discussed, and that the proposed models and methodologies are a valuable contribution, which could be much more valued by associations and organizations, given the implications in the performance and the success of the project.

In addition to considering the presence and impact of the sources and types of conflict on project outcomes, it is recognized that their management is a competence of the directors/managers, who must recognize and resolve them, keeping control of all processes (Clarke, 2010). According to Mohammed, White and Prabhakar (2008), a project manager must not only worry about meeting the project's goals, but must also be attentive to the members' needs and goals, which may create a conflict within the team.

Azim et al. (2010) classify the skills of a project manager as hard and soft. Hard skills are the skills required to perform a certain task, and soft skills are the ones required for relationships with people, personality, resourcefulness, language, camaraderie and optimism (Edelberg, 2006). Soft skills, or micro-social skills, are recognized as critical to the success of project management (Muzio et al., 2007). Also, they suggest that these skills should be displayed by project managers in addition to technical skills, which, according to the authors, can determine the success in complex and ongoing situations. Others, like Petter and Randolph (2009), consider soft skills useful for managing the relationships and communication between team members in a project. Skulmoski and Hartman (2010) conducted a study on soft (or human) skills of information systems' project managers, within which are the negotiation and resolution of disputes and conflicts.

Finally, considering that it is trying to analyze the impact of several aspects of the subfactor "conflict management" (sources, types, resolution mechanisms, among others) on the performance in project management, the criteria normally used to evaluate said performance are analyzed. As in other management disciplines that use performance measurement, a discussion has been established in the field of project management on performance assessment and its impact on the project success (Bryde, 2005). Performance assessment is based on the measurement and monitoring of the performance criteria of the projects (Barclay and Osei-Bryson, 2010) and has traditionally been associated with the variables of time, cost and quality (Pillai, Joshi and Rao, 2002; Wi and Jung, 2010).

Although there is divergence of views on what constitutes a "successful project" (Prabhakar, 2008), different authors distinguish between project success, as measured by the achievement of objectives on

the final product; and project management success, measured usually in terms of time, cost and quality (Baccarini, 1999; de Wit, 1988). In this sense, Cooke-Davies (2002) differentiates the success criteria (the measures by which the project will be evaluated) from the success factors (contributions from management that support success). Project performance is measured by metrics (Luu, Kim, and Huynh, 2008; Marques, Gourc, and Lauras, 2010), and the process is about setting goals, about the choice of an improvement strategy through success factors, and measurement to establish the difference between what is planned and the results (Toor and Ogunlana, 2008, 2010).

Some studies show that it is impossible to generate a universal list of criteria, since they vary from one project to another (Jha and Iyer, 2007, Marques et al., 2010). Others propose adopting new dimensions that broaden the vision, such as management process quality and meeting stakeholders' expectations (Van Der Westhuizen and Fitzgerald, 2005). In general, most current methods are based on the so-called iron triangle (cost, time and quality) (Wi and Jung, 2010); and other categories are added to this. Other researchers propose traditional categories or some additional (Almahmoud, Doloi and Panuwatwanich, 2012; Cho, Hong and Hyun, 2009, Jha and Iyer, 2007; Ling, 2004; Sohail and Baldwin, 2004). Other proposals suggest categories different from traditional (Cheung et al., 2004; Lauras, and Gourc Marques, 2010; Toor and Ogunlana, 2010).

According to Diez-Silva et al (2011), a total of 22 categories are identified from the literature to measure the performance of a project, keeping the usual three (time, cost and quality) as well as customer satisfaction, scope, and effort among others. For the preparation of this document, the three traditional categories plus three other categories taken from the literature described in this section have been used.

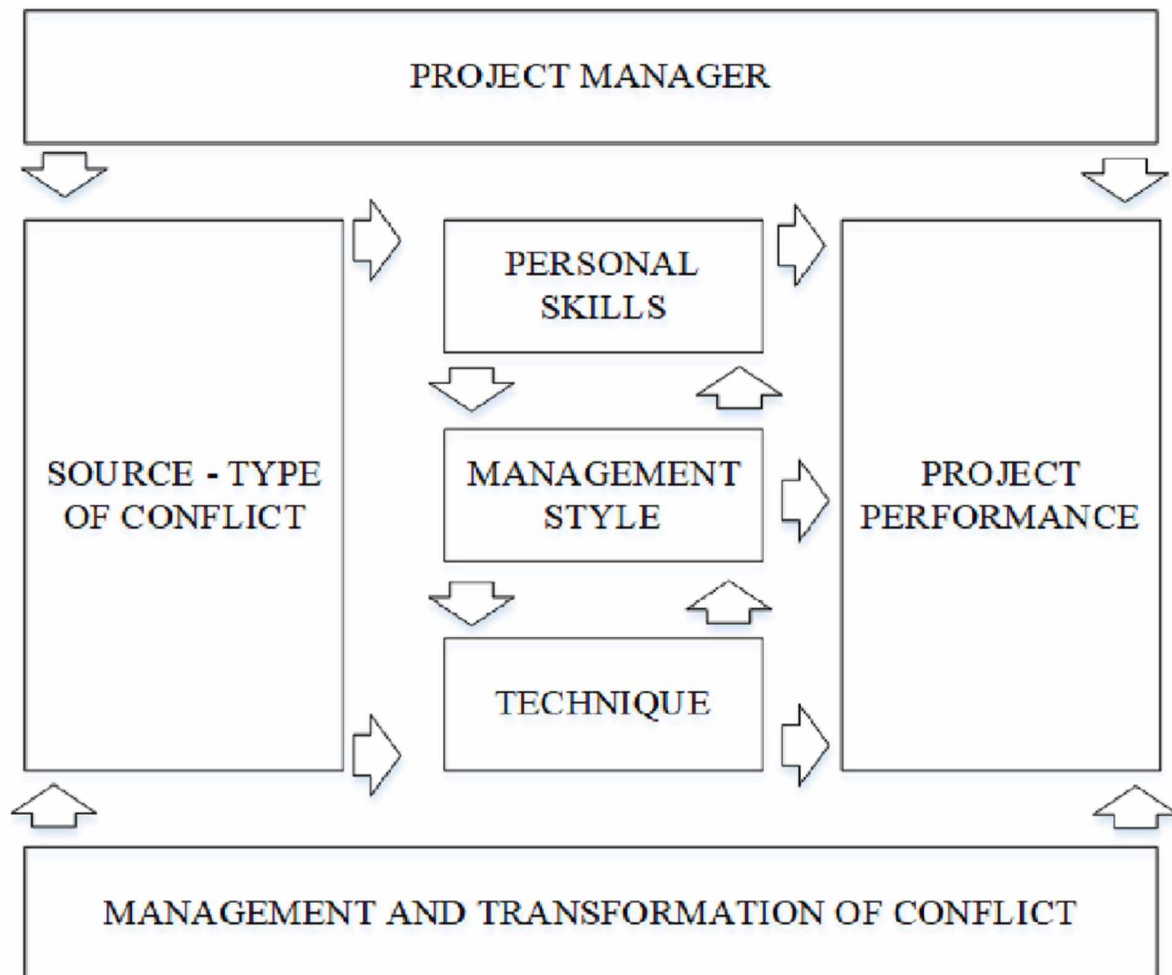
Figure 3 shows that for the resolution of conflicts in project management, several elements are taken into account that determine the effect of said conflict on the performance of the project. These aspects are: source and type of conflict, management style, skills (hard and soft) and the resolution method used. Conflict situations in a project represent a scenario where there should be a combination of strategies, both skills and procedural, for its resolution to be a step towards meeting the goals. A good project manager must develop and deploy personal skills and good judgment in difficult and changing circumstances (Geraldi et al., 2008); one of those situations may be the solution of problems and disputes between team members.

Standards or Bodies of Knowledge contain the most relevant knowledge of the profession in project management (Rozenes, Vitner and Spraggett, 2006). Currently there is a large number of available standards (Ahlemann, Teuteberg and Vogelsang, 2009), and these include methods, techniques and tools that have been developed by professional bodies, to cover all aspects and stages of project management (White and Fortune, 2002). It was considered useful, for the purposes of research, to review standards and Bodies of Knowledge's guidelines related to conflict management in project teams.

Standards and Bodies of Knowledge in Project Management have been compared in various research studies (Montes-Guerra et al., 2011, Wirth and Tryloff, 1995). According to Montes-Guerra et al., monitoring and control is a common issue and a priority for all standards, due to their influence on project performance. Thus, conflict management within the project team should also have relevance to the discipline, since it affects team and overall project performance; and should be assessed constantly during the monitoring and control process.

Overall, The BoK's of Project Management make little distinction on matters related to conflict resolution and human aspects. According to Azim et al. (2010), the Bodies of Knowledge have been questioned for being more focused on hard skills (processes, procedures, tools and techniques) compared

Figure 3. Conflict management process in project management



to soft aspects (people). This is significant if one considers that conflict management in project teams includes both types of skills (personal skills supported by the application of techniques or procedures).

In the PMI's body of knowledge (PMBoK), conflict management is suggested to be one of the techniques to manage the project team. Conflict is shown there as an inevitable issue in teams, which the manager must skillfully resolve to increase project performance (Project Management Institute, 2017). In the norm mentioned above, the problem has not been addressed comprehensively, although the recommendation of six conflict resolution techniques can be highlighted, such as: avoidance, reconciliation, consent, force, collaboration and confrontation.

On the other hand, the IPMA Capability Baseline (ICB) is a competence standard which differs from the other proposals of Bodies of Knowledge in project management. Perhaps because of this, it has given conflict management more space for discussion, addressing it in two of its three groups of competences. The ICB includes aspects of conflict resolution and conflict and crisis, as competences required by managers at technical and behavioural level, respectively (International Project Management Association, 2015).

Likewise, with the ICB, conflict resolution is a technical competence of a manager, who must provide solutions to the project team and its members. To achieve this, the manager must get right the following: the allocation of roles, responsibilities, tasks, team performance assessment and ability to solve disputes. Moreover, the ability to manage conflict and crisis is included as a behavioural competence, focused on the ability to solve problems that arise between people associated with the project. Some methods to apply in conflicts are included, such as motivation, mediation, risk analysis, contract management and procedures.

For the APM (2019), conflict management is a “soft” skill to help manage human resources in projects and this is recognized by some authors (Azim et al., 2010). In its standard it acquires importance as it is included in the people’s section as one of the key factors for effective management of a project (Association for Project Management, 2006). Contracts are highlighted as one of the most common sources of conflict and it is suggested to carry out their resolution in a creative and synergistic manner.

In the ISO-10006 policy, which is updated with the ISO/WD 21500, 2012 version, conflict management is part of the team development process, which aims to improve its performance and that of all its members (The International Standardization Organization, 2003). Although not addressed comprehensively, formal resolution of conflicts should be taken into account to ensure effective teamwork. There are some contributions on the effects of conflicts generated by the project responsibilities, and control actions on interactions as a strategy to minimize conflicts and misunderstandings.

BS-6079 considers the appropriate conflict management (anticipation or preparation) as one of the skills or management competences that a project manager must have. In the standard, team conflict is recognized as a type of conflict that may arise in projects, mainly caused by interpersonal issues, interests, values, culture and technical opinions (BSi British Standards, 2006). In addition, conflict is identified through factors such as hostility, defiance, changes in communication style, voluntary exclusion, endurance, circulation of rumours and notes.

In the PRINCE2 standard, conflict management is a technical competence of the project and team manager coordinates the relationships between all involved parties. The matter is no further analyzed in this process standard (Office of Government Commerce, 2017). On the other hand, in standard P2M of Japan’s Project Management Association, conflict management is understood as a project manager’s ability to make the team maintain good performance throughout its life cycle (Project Management Association of Japan PMAJpmi, 2005).

Table 1 shows a preliminary comparison of the approaches to conflict management in each of the standards, developing a synthesis of the balance. Analysis and comparison are useful because they show that conflict management is an under-addressed subject on all proposals. This indicates that although it is not comprehensively dealt with, conflict management is recognized as a factor in projects, and its resolution is important. Most Bodies of Knowledge assume that conflict management and resolution is a project manager’s ability and is his/her responsibility, considering it more as a competence or ability. Only one of the standards, ISO 21500, recognizes it as a process, but does not deal with it in-depth, nor has a specific procedure for further analysis (The International Organization Standardization, 2015). It is considered that besides being a skill, as recommended by most standards, conflict management must be supplemented with a procedure or method that allows carrying out the project efficiently through a documented technique.

Resolving issues regarding the relationships of team members can improve situations where disputes occur. Most standards assign responsibility for managing and resolving conflict to a project manager, indicating that although rarely on the agenda, the subject is significant for everyone.

Team Conflict Management in Project Management in Colombia

Although the subject has not been dealt with thoroughly in the Bodies of Knowledge, some contributions can be found in the literature. Alam et al. (2010), for example, have researched the use of conflict models and behaviour interpretation techniques. In this regard, they found that the assessment of causes and consequences has been helpful in finding solutions, besides developing skills to manage conflict through experience. The use of models and techniques to solve problems and conflicts makes exploring the causal relationship and ways to handle them more efficient (Alam et al., 2010). Conflict is not an easy issue to deal with; a combination of factors is involved in its resolution like personal skills, experience, tools and techniques, since the temporary nature of the project is a limiting factor in these situations.

STUDY METHODOLOGY

This research aims to characterize conflict in project teams by using qualitative and quantitative strategies. Five points have been reviewed in the literature: (1) conflict in teams, (2) conflict in project management, (3) resolution mechanisms, (4) manager's human skills and competences, and finally, (5) performance measurement criteria.

Conflict management in teams has been contextualized within the project management environment; and the most representative international standards and Bodies of Knowledge (BOK's) of Project Man-

Table 1. Approach to conflict management in international standards of project management

STANDARD	FOCUS	PARAMETER	FACTORS
PMI - PMBOK	Team management technique	Rules	Team
		Communication planning	Personal style
		Function definition	Techniques
IPMA - ICB	Technical and behavioral competence to manage the team and crisis situations	Communications methods	Mediation
		Control team performance	Management style
		Contract management	Motivation
		Assign responsibilities and tasks	Procedures
APM - APMBOK	Ability to manage human resources	Communication	Synergy
		Contracts	Creativity
ISO 10006	Structured process to develop the team	Activities	Consensus in decision making
		Responsibilities	Commitment
		Communication	Labor Relations
PRINCE	Ability to direct the project	Assign roles and responsibilities	Reading ability
		Communication management	
BS6079	Skills or competences	Activity control	Identification by factors
		Requirements	Negotiation
		Communication	Use of authority
P2M	Ability to manage the team	Control	Leadership style
		Project performance	Motivation
		Communication management	

agement have been reviewed and interpreted. This descriptive approach establishes, on the one hand, good practices and, on the other, gaps, as well as research needs on the subject under study.

Once the literature was reviewed, a tool or questionnaire was designed, structured in 5 parts and 19 questions, which aims to gather empirical evidence to analyze the management of conflicts with the criteria of performance of the projects. There are only 2 open questions in the first half of the questionnaire. The rest of the questions are closed, which are structured as follows: 1 dichotomic (Part 1); 10 multiple choice (9 one-only answers, and 1 multiple option); 1 ranking; and 5 estimation (4 of the questions use the following Likert scale: 1 = Never, 2 = Rarely, 3 = Sometimes, 4 = often 5 = always and in the last question the percentage must be chosen according to performance).

The first part, with 8 questions, collects general information. In the second part there are 2 questions, each with 10 and 12 items respectively, with which information has been collected to characterize the sources and types of conflicts, and how often they occur. For the preparation of the items as sources of conflict it has been used the characterizations made by Kerzner (2000, 2009) and Verma (1998). For the items in question 10, which collects information on the existence of conflict, it has used questionnaires designed by Jehn (Jehn, 1994, 1995, 1997; Jehn and Bendersky, 2003; Jehn and Mannix, (2001).

The third part consists of 4 questions; the first 3 are one-choice, to detect the personal style of the manager's conflict management. The Thomas & Kilmann measuring instrument has been adapted, which provides 5 ways to deal with conflict: competitive, collaborative, committed, evasive, and accommodating. In the fourth question, the use of the most common negotiation mechanisms is assessed. The fourth part of the questionnaire was used to obtain the manager's perception on the development of his/her skills. It is divided into 7 items to be ordered; for which the skills and competences synthesized by Skulmoski and Hartman (2010) have been used.

The fifth (4 questions), and last part of the questionnaire, explores the frequency of progress measurement on the project that the interviewee has recently completed and the degree of compliance with the variables that determine its performance. Thus, based on the literature review, it has chosen 6 performance criteria that determine the success of projects (time, cost, quality, activities, scope and stakeholders' satisfaction).

The questionnaire (see Appendix 1) was administered to project managers who were familiar with the discipline and performance measurement. For this, a database of professionals from a Public University of Colombia is consulted, selecting them with the following criteria:

- 1) Professional training in project management, project management specialists;
- 2) Professional experience in the area.

A pilot test was conducted with interviewees in order to refine the language of the questions, to better understand the statements contained therein, and to obtain preliminary results. Subsequently the questionnaire was administered to 117 project managers in various sectors, via e-mail and some in person. The information collected in the questionnaire is shown in the following section, which provides greater importance to the relationships between sources, types and mechanisms of conflict management on project performance. Statistical analysis of the data obtained was performed using Excel, the correlation diagramming with SigmaPlot, and histogram diagramming. Analysis and discussion

SOLUTIONS AND RECOMMENDATIONS

This section presents an analysis of the results obtained from the application of the questionnaire to project managers in Colombia. In the first part of this section a descriptive statistical analysis of the demographic characteristics of the sample is showed. The second part is shown a descriptive study of the styles to address the conflict within projects and skills and competencies that Colombian managers identify more important to resolve conflicts. Finally, correlation analysis between project performance and other variables such as sources of conflict, style of conflict management and conflict resolution mechanisms are presented.

Data have been obtained by using the information from the questionnaire. These data have been analysed focusing on topics of interest to empirically validate some of the hypotheses found in the literature on conflict management in projects. Sex, age, education level, profession and occupation, to determine if any of these variables has an impact on the conflict generation or resolution, classify results. Other variables such as number of managed projects, project type and number of people in the team have been used to characterize the determinants of the conflict (sources, types, styles, mechanisms) with any of these variables.

The overview analysis indicates that the majority of managers interviewed are female; 60% are women and 40% are men. Half of the study's population is between 20 and 30 years, 30% is between 31 and 40 years. The most common education level is doctorate and specialization, indicating that most managers are postgraduates, and only a minority has only professional studies (10%). Profession and performance are characterized as follows: 50% of the population is in the area of economics and business, followed

Table 2. Sample's overview results

Type of projects		Gender	
Investigation and development	40%	Male	40%
Information technology	10%	Female	60%
Development of organizations	40%	Age	
Product development	40%	20-30	33%
Marketing / Advertising	10%	31-40	27%
Process improvement	10%	41-50	23%
Educational	10%	51-60	12%
International cooperation	10%	+60	5%
Scholarship		Profession	
University	14%	Administration	42%
Specialization	41%	Engineering	46%
master's degree	29%	Health	6%
Doctorate	16%	Laws	2%
Managed projects		Humanities	4%
1-5	42%		
6-10	32%		
+ 11	26%		

by engineering and architecture; these being the two most representative (90%). The table 2, shows the main results of the sample's overview.

The data indicate that the project types most executed by the interviewees are: Research and development, organizational development, product and service development. The above corresponds with the education background characteristics of the sample, i.e., economics and business, and engineering. 60% of the sample has managed between 1 and 5 projects, and the interval of managed projects is mostly between 1 and 10 (90%). The size of the team falls in the first category (between 1 and 5) for half of the interviewees, indicating that most have managed small projects.

The gender variable has been linked to performance variables, finding that for both men and women the best results are achieved with the project scope, which would indicate that there is no influence of gender of the project manager on the project deliverables. Moreover, men have the lowest scores in cost, and women scored lower on the project's time. Regardless of the experience in managing projects, it has been found that the best performance index is the project's scope; whereas with increasing experience, the lowest performance index moves from time to cost.

The most frequent sources of conflict have been identified within the established variables, validating the characterization found in the literature. Within the types of conflict - structured in three composed variables, each with four items - it has been determined which occurs most frequently. Both for the sources and for the types of conflict, their relationship with the assigned variables has been evaluated to measure the performance of the project.

Interviewees' personal style of managing conflict has been identified in order to determine which one is most prevalent in project management, and whether any specific style is associated with a particular variable. The frequency of conflict resolution techniques during Phases of the project life cycle is evaluated. These have been linked to the performance variables in order to ascertain whether their influence is positive or negative. Managers' skills and competences have been assessed, identifying those that the interviewee considers more or less developed. With this, the priority competences in project management for professionals are determined.

Then, the type, the frequency of measurement of the performance indicators and the final percentage of completion for each project have been characterized. The variables that determine the performance have been associated with the variables identified for the types, sources and mechanisms of resolution, checking whether there is correlation between them and the project performance.

The sources that most conflicts generate in projects are agenda monitoring and control, and personality related issues. Those that generate the least conflicts are the allocation and distribution of human resources, and budget estimation and allocation. The most common type of conflict is task conflict and the least common is process conflict. This is understandable due to the very nature of the project, which develops through tasks and often consists of multidisciplinary teams. The above is probably due to the fact that the process is the manager's responsibility, whereas the tasks are the team's responsibility.

The most representative style of managing the conflict in the sample of study is the collaborative one; which, according to the literature, works to find a solution that satisfies those involved, and benefits them. This style is the most characteristic, because projects require conflict to be managed with coordination, causing the least possible disruptions in the project objectives. The next representative style is the competitive, defined as the one that pursues one's own interests and uses power to gain one's position. It can work on projects because in many cases the results are imposed on other factors. Comparing the styles of conflict management concludes that collaboration and competition simultaneously show better results in the variables scope and quality of projects, although the competitive style shows better results

for each variable. For the skills and competencies that must be developed by the project managers, an average of the ratings assigned by the interviewees to each of the skills extracted from the literature has been estimated. The most importance has been given to the professionalism variable (ethical behaviour, results orientation, lifelong learning and technical skills). General skills in project management and communication have also been valued as important.

Figure 4 shows the results with respect to the interviewees' personal style of dealing with conflict. Also shown are the average ratings of skills and competences.

Through the descriptive statistical analysis, the correlations between the variables that correspond to the sources and the types of conflicts with the performance criteria of the project have been studied. With respect to the sources of conflict, a negative correlation is generally found with project performance. The strongest negative correlation occurs between the agenda's monitoring and control and the project's scope. That is, the conflicts generated by monitoring can negatively affect the project's scope. Another variable with strong negative correlation is the conflict generated by the way the project is organized and managed (administrative procedures), and project timeline; i.e., administrative disorganization influences project time.

Regarding the correlation between types of conflict and project performance, the most negative correlation variable is process conflict on project cost. This may be because any disagreement that arises regarding the resource efficiency can increase the budgetary allocation. Other negative correlations are presented between relationships conflict and the project time and cost. The correlation between the variables that correspond to the mechanisms of conflict management and progress reports with performance criteria has been examined. With respect to mechanisms, a strong positive correlation is generally found between negotiation and project quality. This means that the application of negotiating solutions improves project performance regarding quality criteria, maintaining the expectations and requirements of those involved. Likewise, there is positive correlation between negotiation and stakeholders' satisfaction.

As for the correlation between the frequency of progress and performance reports, a strong positive correlation is found between activity reports and project timeline. This means that the greater the activity monitoring is, the better are the results achieved in time. The same situation occurs between the frequency of timeline reports and performance in the same category.

Figure 5 shows the correlations' average, the left part illustrating the correspondence between source and type of conflict on all the study's performance variables. The results of this correlation are negative, indicating that their presence affects project performance. Of all parameters assessed, cost and activities are the most affected by conflict sources and types. The right side of Figure 5 illustrates the correspondence between resolution mechanisms and progress reports on all the study performance variables. The results of this correlation are positive, indicating that their presence improves project performance. Of all parameters assessed, time and activities are the most benefited.

FUTURE RESEARCH DIRECTIONS

To consider applying conflict resolution techniques used in other disciplines in cases of project management. To develop technique implementation methods for conflict management in project management environments. To conduct the study in other contexts, such as Spain, or Central America, in order to compare the perspective of other cultural and geographic environments.

Figure 4. Results of styles, skills and competences of managers

Source: The authors

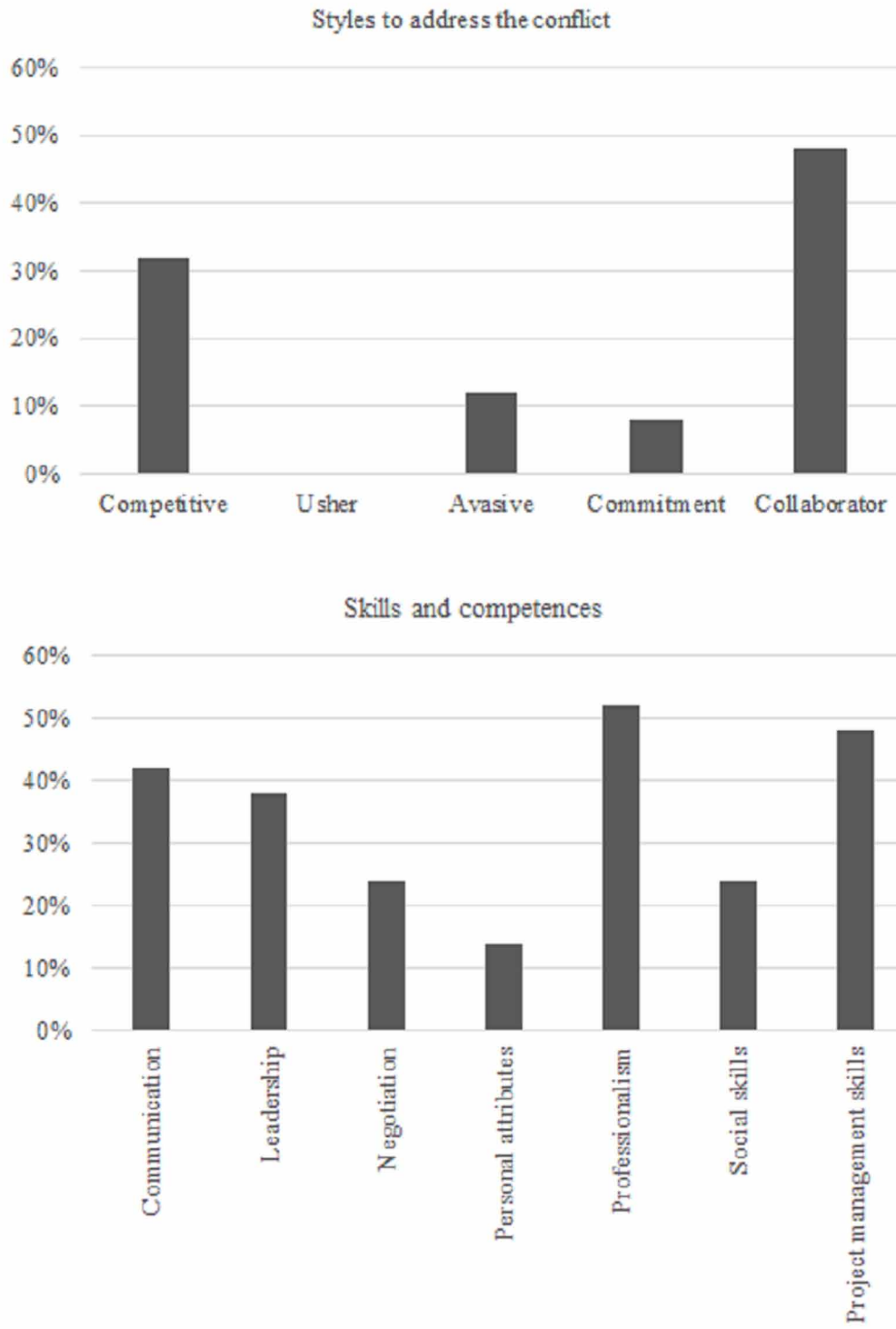
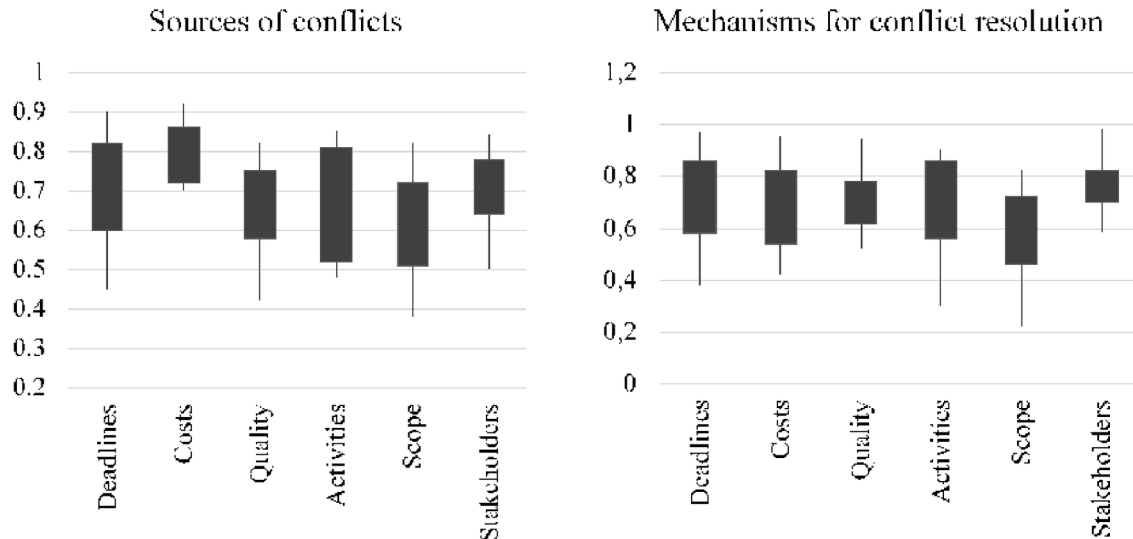


Figure 5. Correlation between variables and project performance

Source: The authors



CONCLUSION

Based on the review and interpretation of project management's literature and Bodies of Knowledge, as well as the application of the questionnaire, this research provides empirical evidence to establish the relationship between team conflict and project performance. Little and inconclusive evidence is observed regarding the importance given to conflict management in the teams involved in a project. However, the results of the empirical work show that conflict is present in project teams and is a factor that has direct implications on the project performance.

The frequency of conflict sources and types affects project performance, with greater or lesser impact. There is no consensus as to which conflict management style is best, but the empirical evidence focuses on collaborative and competitive managers. The latter in some cases obtain better results on performance. The most influential conflict on project performance is task conflict. Although process conflict is the least common type, its impact is also detrimental on cost performance. Therefore, efforts should be made for its identification and timely prevention.

Using conflict resolution mechanisms, such as negotiation, improves project performance. The frequent preparation of progress reports increases the chances of obtaining better results. The development of general skills for project management is valued as an important aspect to improve management and, thus, be more prepared for conflict resolution.

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KEY TERMS AND DEFINITIONS

Arbitration: It is a mechanism for the resolution of conflicts, where the parties in dispute do not reach an agreement, decide to appoint an interested third party who will be responsible for dictating how the dispute should be resolved.

Conflict: Situation in which due to difference of interests or points of view, two or more members of the project team or an interested party of the project and the project team, enter into a confrontation or dispute that may affect the achievement of the objectives of the project.

Conflict Management: Form or strategy that is implemented by the project manager or by an interested party of the project in order to solve disputes or confrontations caused within the project team or between this project team and another interested party of the project.

Mediation: Corresponds to a strategy for solving conflicts, in which an impartial third party intervenes in order to facilitate communication and obtain a result that is accepted by the parties in dispute.

Negotiation: Corresponds to a strategy for the resolution of a conflict in which one seeks to solve the dispute in such a way that a favorable outcome is obtained for each of the parties in conflict.

Project Team: Group of people who develop activities related to the life cycle of the project.

Source of Conflict: Cause or reason for which a confrontation or dispute is generated during the life cycle of the project. The sources of the conflict can be internal or external. In the first case, it usually corresponds to disputes over the use of resources that are necessary for project activities, and in the second case, they correspond to disputes due to differences in interests between groups of stakeholders.

Chapter 4

Incidence of Organizational Culture on Management Effectiveness of Information Technology Projects

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ABSTRACT

This chapter describes the findings of a research aimed to determine the cultural characteristics which have incidence on the management effectiveness of IT projects. A quantitative study was carried out. Confirmatory factor analysis (CFA) and structural equation modelling (SEM) were applied. A random sample of 139 respondents conformed by leaders and team members who developed IT projects in private companies from different economic sectors located in Bogotá, Colombia was used. The evidence shows that the adaptation to solve problems has incidence in the management effectiveness of IT projects and the compliance of stakeholder expectations can be predicted from the alignment level of the projects with the strategy and the consideration of their needs and opinions. The study extends the theory in project management and information technology. The results can guide the efforts of project offices to identify cultural characteristics which can be intervened to enhance the project success.

INTRODUCTION

The organizational culture determines the attitudes of people and their performance in the daily tasks, as well as in the interaction among the areas of the organization (Schein, 2009). Its members learn the behaviors which are accepted and valued by the executive levels and collectively assume those which are considered appropriate. In the same way, these attitudes and behaviors are reflected in the project execution. It has been found that a positive disposition of the organization towards project management, expressed through the support of the executive level, is a cultural aspect that favors its results (Kendra

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and Taplin, 2004). However, it is necessary to carry out additional research to identify other characteristics of the organizational culture which may facilitate the development of projects (Morrison, Brown and Smit, 2008).

IT is changing the way people interact in the social context, how they develop their work activities and in general, how they act on a day-to-day basis, through the information that technological solutions provide and the possibilities of creation that they are made available to users. The products which are developed with IT projects evolve to the extent that people have new needs. This situation leads this type of projects face a constant degree of uncertainty and changes during its life cycle (Tiwana and Keil, 2009; Standish Group International, 2013).

On the other hand, IT projects require integrating knowledge and skills in people of diverse disciplines, increasing their complexity. In this process of interaction among the stakeholders, several flaws have been detected which are typically presented in IT projects, such as the definition of unrealistic expectations, the difficulty in solving problems at the individual or team level and the lack of involvement of end users (Nelson, 2007). However, these factors leave the context of the individual project and they are a manifestation of cultural characteristics of the organization in which the projects are developed.

The expectations of customers and users determine the functionalities of the products and services generated by IT projects (Tiwana and Keil, 2009). But also, their expectations determine the way in which the effectiveness of their management is measured (Heerkens, 2001; Shenhar, Dvir, Levy and Maltz, 2001). Traditionally, IT projects are valued in terms of compliance with scope, time, cost, requirements and quality (SGI, 2014). In Colombia, according to the perception of 355 IT professionals, while 50% of the participants indicated that the projects accomplish the assigned budget, 35% considered that the projects comply the schedule (Asociación Colombiana de Ingenieros de Sistemas ACIS, 2014). However, this measurement needs to be complemented with other criteria which include aspects related to stakeholders such as customers or users, the work team and contractors.

Particularly in IT projects it has been found that the commitment of the organization to provide time and resources, the level of formalization of project management practices and cooperation among areas are related to compliance with the scope, time and cost (Aladwani, 2002; Milosevic and Patanakul, 2005; Thamhain, 2004). Many of the studies about IT projects carried out so far have identified some cultural factors which affect the project success without having an integrated model of organizational culture. For the reasons which were stated previously, the following research question is formulated:

What are the characteristics of organizational culture that have incidence on the management effectiveness of IT projects?

Therefore, the present research is aimed to establish the incidence of the organizational culture on the management effectiveness of IT projects. The structure of this chapter is as follows. In section 2, 3 and 4, the review of literature is presented; in section 5, the elements of the methodology are detailed including sample and techniques used for the analysis; in section 6, the findings obtained are showed followed by the conclusions.

ORGANIZATIONAL CULTURE

Organizational culture has been studied by different disciplines like anthropology, sociology and psychology. From an anthropological view, the organizational culture is considered a factor of contingency which affects the general functioning of the organization (Allaire and Firsirotu, 1984). From a sociologi-

cal framework, it is a system composed of symbols with a specific meaning given by the members of the organization which are expressed through language, habits, rituals or stories (Ouchi and Wilkings, 1985). Finally, from a psychological perspective, the organizational culture constitutes a pattern of external attitudes and behaviors which are built on values, beliefs and assumptions that individuals share on a day-to-day work (Ouchi and Wilkings, 1985; Schein, 2009).

According to Schein (2010), the founders of the organizations establish some rules and norms which are spread by the executive level and learn by the members. Individual uses them to solve problems, to differentiate themselves in the external context of the organization and integrate with the others in the internal level. The different expressions of the organizational culture provide an identity to the members and a sense of belonging (Ravasi and Schultz, 2006). When people are new in an organization, they adopt attitudes and behaviors in order to fit. Nevertheless, if the values and beliefs of an individual are against the common values or beliefs, the person might leave the organization (Schein, 2010).

Attitudes that people adopt towards the tasks to be realized in the organization and the way they behave, have an impact on organizational effectiveness (Fey and Denison, 2003; Naor, Lindermand and Schroeder, 2010). There is empirical evidence of this relation. Some studies have determined relation between empowerment and job satisfaction (Denison et al., 2006; Tuuli and Rowlinson, 2009), adaptability and knowledge management practices (Gold, Malhotra and Segars, 2001; Shafei, Ghaderzadeh, Salavati and Lavei, 2011), internal cohesion and knowledge management practices (Schmitz, Rebelo, Gracia and Tomás, 2014) and clan culture and market share and sales growth (Yazici, 2011).

ORGANIZATIONAL CULTURE IN PROJECT ENVIRONMENT

Models or constructs of organizational culture have been used to find the relationship between culture and project effectiveness (Morrison, Brown and Smit 2008; Stare, 2012; Yazici, 2011). Research has established the relation among specific cultural aspects and project success (Janz and Pattarawan, 2003; Lee, Park and Lee, 2015; Seibert, Silver and Randolph, 2004; Teller and Kock, 2013; Thamhain, 2013). However, the results obtained so far do not indicate high and significant relations among these two variables, requiring more empirical evidence to support or reject the possible impact of culture on the effectiveness of project management.

Martin (1992) argued that culture can be studied as a set of coherent and homogeneous interpretations that integrate the members of an organization, or as a grouping of culturally differentiated characteristics among established groups of the same organization, which constitutes subcultures. This argument is the basis for proposing the existence of an organizational culture in project environment, which is derived from the experiences shared by stakeholders (Bryde, 2003; Kendra and Taplin, 2004).

Some authors have integrated cultural characteristics linked to the project success by means of constructs (Morrison et al., 2006; Stare, 2012). Their proposals offer an initial support to the possible existence of a subculture, which is composed of the attitudes and behaviors of stakeholders who participate in the project execution (Bryde, 2003; Kendra and Taplin, 2004).

Particularly, Ariza Aguilera (2018) defined a model called “organizational culture model in a project environment” as a framework of explicit attitudes and behaviors which represent values, norms and collective beliefs shared by project stakeholders. A qualitative investigation that used the social constructivism as epistemological framework and the Constructivist Grounded Theory method was carried out. The model is composed by thirty-two variables related to attitudes and behaviors of the stakeholders

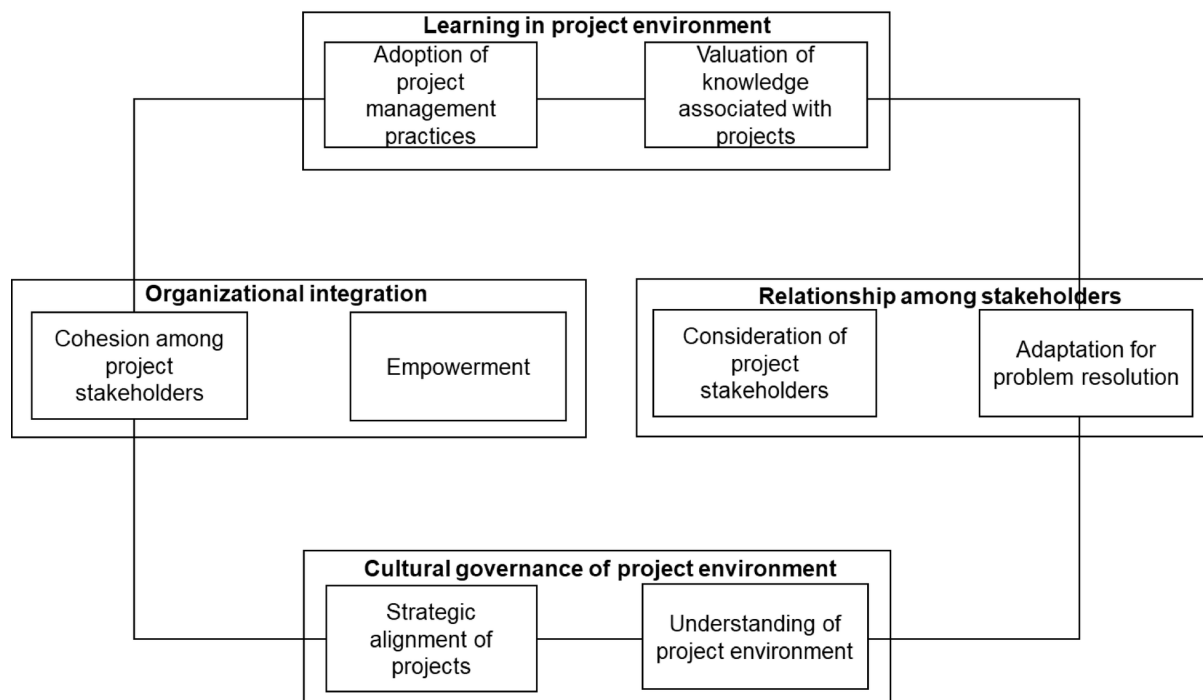
which facilitate the project effectiveness. The model was built taking as initial reference the literature review. Nevertheless, during the process of creation, the feedback of eighty-two project stakeholders of different industries allowed the adjust of the model. In consequence, it is the result of the interaction between the researcher and the participants.

The organizational culture model in a project environment is comprised of four dimensions and eight categories. The dimensions are: (1) cultural governance of project environment, (2) learning in project environment, (3) organizational integration and (4) relationship among stakeholders. Each dimension is made-up by two categories. The cultural variables are distributed into eight categories named as follows: (1) strategic alignment of projects, (2) understanding of project environment, (3) adoption of project management practices, (4) valuation of knowledge associated with projects, (5) cohesion among project stakeholders, (6) empowerment, (7) consideration of project stakeholders and (8) adaptation for problem resolution. The structure of the model is presented in Figure 1.

MANAGEMENT EFFECTIVENESS OF IT PROJECTS

Project success has been related to the terms performance and effectiveness without making distinction (Belout, 1998). The project management success traditionally has been associated with the fulfillment of criteria such as time, budget, scope and quality, measuring the results of the effort made by the leader and the team, who have the responsibility of executing the project under these conditions (Cooke-Davis, 2002; Kerzner, 2001; Westerveld, 2003).

Figure 1. Structure of the organizational culture model in project environment



In Colombia, the association of system engineers reported the results of a survey which was collected annually between 2008 and 2012 to 355 IT professionals. While 50% of the participants indicated that the projects accomplish the assigned budget, 35% considered that the projects comply the schedule (Asociación Colombiana de Ingenieros de Sistemas ACIS, 2014). The comparison of both variables during the five years showed that the compliance with the schedule had a significant descend from 41% in 2008 to 28% in 2012 (ACIS, 2014).

According to De Wit (1988), the project success must be associated with the fulfillment of its objectives by the measurement of the expectations manifested by different groups of stakeholders. With this approach, the number of criteria to make the assessment is extended. The perception of the interest groups regarding the project performance can vary and even be in conflict and, hence, the need for its inclusion (Hussein and Klakegg, 2014).

The success of the projects has been associated with the assessment of the perception of the clients or final users of the products or results of the projects. Criteria have been included, such as the achievement of the functional performance of the products delivered to them, the level at which the original problem was solved, the use of the product by the users, the degree of compliance with the results and the satisfaction of users and clients with the tangible benefits generated by the project (Bryde, 2008; Heerkens, 2001; Shenhar et al., 2001).

Additionally, it has been proposed as a criterion to measure the success of the projects, their strategic impact. This has been measured as the degree in which strategic decisions direct the management of projects (Morrison and Brown, 2004), the clarity in the identification of intangible benefits generated with the development of projects (Bryde, 2008), the degree in which that the projects enable the fulfillment of strategic objectives of the organization (Ariza, 2017) and the level at which the management of the projects is integrated with the daily operations of the organization (Morrison and Brown, 2004).

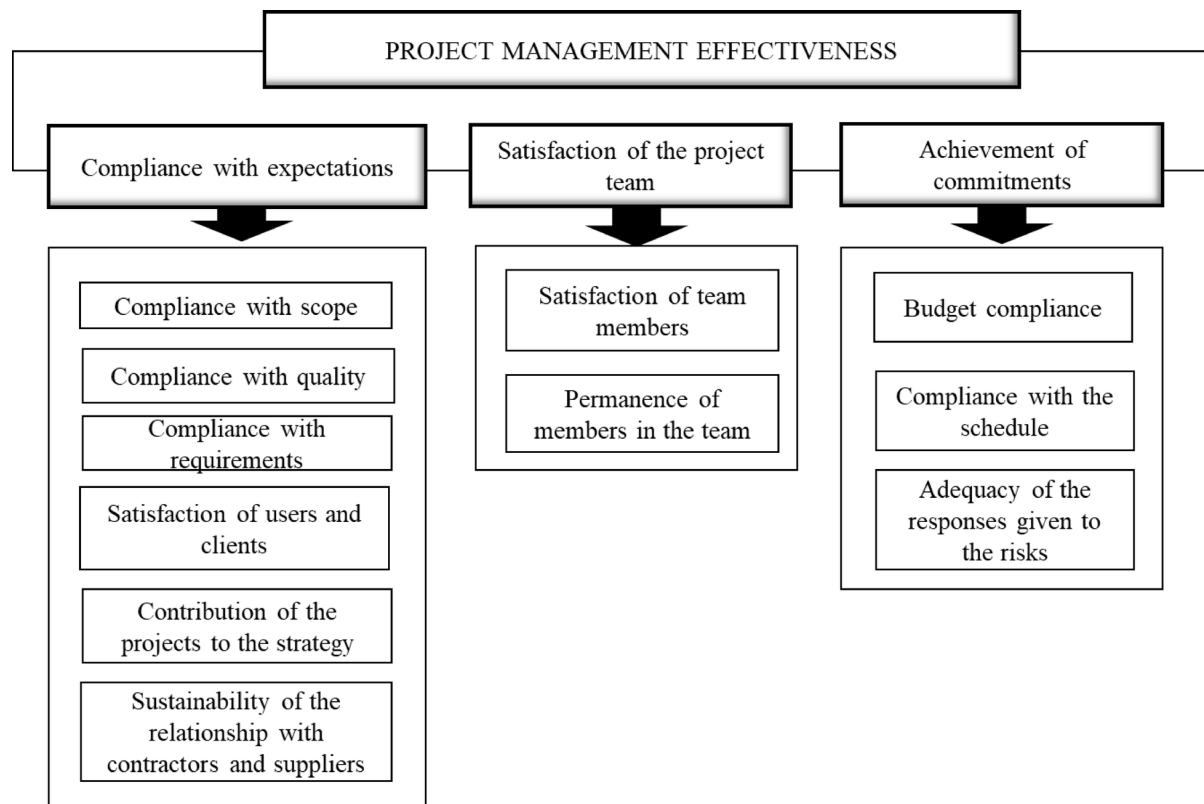
On the other hand, the evaluation of the success of the projects has been extended to other stakeholders such as team members, including criteria related to the degree of happiness perceived by team members working on the project (Bryde, 2008; Yazici, 2011), the continuity of the team until the end of the project (Ariza, 2017; Sánchez, Moreno and Velosa, 2014) and the growth and development of the team as a result of the execution of the project (Heerkens, 2001). In the same way, the sustainability of the relationship with suppliers and contractors has been included as a criterion for measuring the success of the projects (Ariza, 2017; Bryde, 2003; Rowlinson and Cheung, 2008).

The effectiveness of the project management has been defined as the satisfaction of the stakeholders with the results obtained with the project management (Ariza, 2017). Consequently, the effectiveness of project management involves multiple criteria that can be framed by two trends in measurement: on the one hand, efficiency in the management of resources and on the other, the perception of the stakeholders involved in the execution of the projects. Both trends were embraced by Ariza (2017) who proposed a construct of eleven indicators distributed into three dimensions. As a result of an exploratory factor analysis, the three dimensions were named as: (1) Compliance with expectations, (2) satisfaction of the project team and (3) achievement of commitments (Figure 2).

CULTURE AND MANAGEMENT EFFECTIVENESS OF IT PROJECTS

There is not exist enough studies which confirm or reject the relation between organizational culture and project effectiveness. Some authors have carried out research to determine the incidence of cultural

Figure 2. Components of the project management effectiveness



characteristics on IT project success (Aladwani, 2002; Ching Gu et al., 2014; Milosevic and Patanakul, 2005). Taking as reference the cultural categories defined by Ariza Aguilera (2018) in the organizational culture model, the following paragraphs are aimed to detail the theoretical support on which the hypotheses of the present research were proposed.

Strategic Alignment of Projects

The link between project objectives and organizational strategy is defined as the strategic alignment of projects. This category is associated with the role played by the organization in the results of the projects. One of them is the definition of a clear business vision (Denison, Janovics, Young and Cho, 2006), which use projects as a means to achieve the objectives (Gold et al., 2001; Shenhar et al., 2001; Tuuli and Rowlinson, 2009). At the same time, the benefits of the projects will help to comply the short and long-term objectives of the organizations (Shenhar et al., 2001). The benefits generated for the stakeholders exceed the limits and the life cycle of the projects (Musawir et al., 2017), and facilitate the reach of organizational strategy.

Morrison and Brown (2004) defined the strategic impact of the projects in terms of two variables. For the one hand, the grade in which projects are associated to objectives of the organization and for other part, the integration of the project management with the diary operations in the company. Posteriorly,

Morrison et al. (2008) found moderate correlations between the strategic impact of the projects and the organizational culture.

The effort of the organization to support the fulfillment of its strategy through the results of the projects (Bryde, 2008; Shenhar et al., 2001), the clear identification of their benefits (Morrison and Brown, 2004; Aladwani, 2002), the decision-making which take into account the greatest benefit for project stakeholders (Aladwani, 2002; Thamhain, 2004) and objective criteria to define the project portfolio (Morrison et al., 2006; Teller, 2013) are considered cultural characteristics which allows the alignment of the projects with the strategy (Ariza Aguilera, 2018). In consequence, the following hypothesis is formulated:

Hypothesis 1 (H1): There is a positive and significant relation between the strategic alignment of projects and the management effectiveness of IT projects.

Understanding of Project Environment

The understanding of project environment is a cultural category that is associated to the awareness of the organization regarding the need to manage the projects. Authors as Bryde (2003) and Teller (2013) consider that this aspect is part of the organizational culture. Kendra and Taplin (2004) conducted a qualitative research in the technology division of a manufacturing company. The researchers found that the willingness of the organization to manage their projects resulted in the support of the executive level and the compromise to provide time and resources for the projects. The company offered resources to take actions as the implementation of a project management methodology for managing changes and risks, the corresponding training and the setting up of an office for the centralization of project management.

Aladwani (2002) found positive but low correlations between the support of the executive level and the compliance with the scope, the schedule, the cost and the operational efficiency of the projects. Similarly, Stare (2012) determined that the variable that had a more significant impact on the project management performance was the positive attitude of the executive level with respect the execution of projects.

The support given by the executive levels (Young and Poon, 2013), a flexible attitude toward changes which the projects constantly face (Mueller, 2014), the conviction that risks must be managed (Bivowo and Taufik, 2017; Gu et al., 2014; Teller and Kock, 2013; Tsiga, Emes, and Smith, 2016) and the availability of time and resources for projects (Karlsen, 2011; Stare, 2012) are considered cultural characteristics which allows the alignment of the projects with the strategy. Therefore, the following hypothesis is put forth:

Hypothesis 2 (H2): There is a positive and significant relation between the understanding of project environment and the management effectiveness of IT projects.

Adoption of Project Management Practices

The consistent use of terms, policies and procedures to manage projects was identified as a cultural category named as the adoption of project management practices. When project management practices have been internalized in the organization, there is a concern to disseminate and standardize the terms of project management (Bryde, 2003; Karlsen, 2011; Stare, 2012), so that communication among people is improved. The standardization of way project leaders and their team execute the projects in the or-

ganization is legitimized by means of the creation of procedures and policies which address the project administration and the application of documentation norms (Alavi, Kayworth, and Leidner, 2005; Stare, 2012). These practices preserve the knowledge acquired by the company with the project execution and guarantee its promulgation (Golini, Kalchschmidt, and Landoni, 2015).

Loo (2002) used a sample of 150 heterogeneous organizations located in the province of Alberta, Canada, which were characterized by having professional project managers. He found that one of the barriers to the development of best project management practices was the resistance of the staff to learn and use tools to manage the projects, concluding that the culture could negatively impact the success of the projects.

Indeed, Milosevic and Patanakul (2005) conducted a quantitative study to test the degree of correlation between the standardization of project management practices and their success. They used a sample of 55 members of product development projects in the electronic and software industry. The research participants had roles of leader and team members. In their research, the project success was measured according to the compliance with cost, schedule, quality and customer satisfaction. The degree of standardization existing in the organization was measured in terms of: (a) processes, (b) information management system, (c) tools and (d) metrics. The highest Pearson correlation coefficients were found between the project success and the standardization of processes ($r = 0.43$) and tools ($r = 0.48$). Taking into account the previous results, it can be deduced the following hypothesis:

Hypothesis 3 (H3): There is a positive and significant relation between the adoption of project management practices and the management effectiveness of IT projects.

Valuation of Knowledge Associated with Projects

The importance given by the organization to the knowledge used and generated by projects was identified as a cultural category named the valuation of knowledge associated with projects (Ariza Aguilera, 2018). The learning is generated when the organization values the knowledge (Templeton, Lewis and Snyder 2002; Schmitz et al., 2014) and people assume behaviors like sharing information (Berman, 2010; Davenport, De Long and Beers, 1998; Zulch, 2014), allowing the access of project teams to necessary data (Heravi, Coffey and Trigunarsyah, 2015), creating and applying the acquired knowledge (Alavi and Leidner, 2001; Lee and Choi, 2003) and analyzing the errors so that they are not committed again in the future or the successes to replicate them (Davenport et al., 1998).

While the adoption of project management practices refers to the level at which people use them consistently and have become their usual way of working, the valuation of knowledge associated with projects, denotes the degree in which the organization is aware of the importance of the knowledge required and generated by their projects. The organizational learning not only involves the definition of errors and failures so that they are not committed in the future (Davenport et al., 1998), but also the generation of lessons learned (Alavi, Kayworth and Leidner, 2005) and its transformation into procedures, controls, indicators or models (Templeton, 2002) that improve the effectiveness of the actions that are carried out and the decisions that are made in the organization. However, the learning cycle also occurs in the opposite way: De Long and Fahey (2002) state that it is culture that defines what is the knowledge that is valued by the organization and what is the type of knowledge that must be maintained to guarantee a sustainable advantage.

Janz and Pattarawan (2003) proposed a model in which they relate three variables: (a) culture centered on knowledge, (b) learning process and (c) learning outcomes. The measurement of the model used a sample of 270 individuals belonging to 28 project teams, who worked in 13 companies located in the United States and Canada. The answers were given by people with the role of project team members and stakeholders, related to development projects and implementation of information systems. The authors concluded that insofar as there is a culture centered on knowledge, there will be greater manifestations of cooperation and learning which will increase the satisfaction of individuals with their work and the results of the team. In consequence, the following hypothesis is deduced:

Hypothesis 4 (H4): There is a positive and significant relation between the valuation of knowledge associated with projects and the management effectiveness of IT projects.

Cohesion Among Stakeholders

The cohesion among project stakeholders was defined as the capacity of different areas of the organization to work together and share resources in order to achieve the project success. The cohesion among members of an organization was identified by Denison et al. (2006) as a cultural characteristic. Difficulties between project leaders and functional personnel derived from internal conflicts can affect not only the prioritization of the projects in the portfolio (Beringer, Jonas and Kock, 2015) but also the solution of problems.

Ching Gu et al. (2014) conducted a study aimed to establish the relation between organizational culture and IT project success. They used a sample of 261 IT professionals who belonged to American and Chinese enterprises. The study encompassed four cultural variables: (a) institutional collectivism, (b) result orientation, (c) positive work environment and (d) tolerance to risk. The construct to measure project success comprised some variables like the compliance with budget, the accomplishment of the stakeholder expectations and the satisfaction of the project team. The results showed positive but low correlations among project success and institutional collectivism. This variable was defined as the extent to which the organization encourage the collective actions among its members. Institutional collectivism has a similar definition like cohesion among stakeholders. For this reason, the following hypothesis is proposed:

Hypothesis 5 (H5): There is a positive and significant relation between the cohesion among stakeholders and the management effectiveness of IT projects.

Empowerment

Empowerment refers the effort of the organization to develop the skills required by project team, the autonomy or influence that is allowed to individuals in their work environment (Thamhain, 2004), the responsibility that is delegated to groups to perform the tasks and the inclusion of people in decision-making (Mathieu, Gilson and Thomas, 2006; Miklosik, 2015; Wall, Wood and Leach, 2004). The studies carried out by Seibert, Silver and Randolph (2004) and Tuuli and Rowlinson (2009) established the relationship between the empowerment and the performance of the project teams.

Seibert, Silver and Randolph (2004) defined a research model that sought to establish the relation between empowerment and performance of project teams. The sample consisted of 301 employees of a

high-tech manufacturing company located in the United States. The respondents corresponded to electrical, mechanical and systems design engineers that comprised 50 project teams. Seibert et al. (2004) measured the performance of the project team according to the perception of heads of the executive level with respect to: (1) compliance with schedule, (2) compliance with cost, (3) compliance with quality and (4) performance general. A significant correlation was found between empowerment and team satisfaction ($r = 0.73$) and a moderate correlation between empowerment and performance of the project team ($r = 0.33$). Therefore, the following hypothesis is put forth:

Hypothesis 6 (H6): There is a positive and significant relation between the empowerment of project stakeholders and the management effectiveness of IT projects.

Consideration of Project Stakeholders

The attention to the position, expectations and needs of direct and indirect participants of the projects given by the organization was defined as a cultural category named consideration of project stakeholders. The ease with which they can express their opinions aid the decision-making (Ambtman, Riel, Lauche and Hammedi, 2014; Rowlinson and Cheung, 2008), particularly, when they participate during the whole project life cycle (Heravi et al., 2015).

According to Bourne (2013), each stakeholder brings a value proposal that is derived from their knowledge or the resources with which they contribute to the project. This value proposal will be affected by their interests, rights, property, impact or influence on activities in the organization (Bourne, 2013). Therefore, the following hypothesis is deduced:

Hypothesis 7 (H7): There is a positive and significant relation between the consideration of stakeholders and the management effectiveness of IT projects.

Adaptation for Problem Resolution

The adaptation for problem resolution was considered by Ariza Aguilera (2018) as a cultural characteristic. It refers to the concernment for solving issues in projects by negotiating and making decisions. Aladwani (2002) found the project success depends of the problem resolution defined as a competence of the team. The author evidenced that the solution of the problems that the IT projects have is reached when a collective vision exists to determine the best alternative and there is a collaborative effort of the team members.

The reinforcement of the organization to listen the opinions of the stakeholders in order to reach agreements (Verma, 1997), the timely decision-making to solve problems quickly in order to move forward (Denison et al., 2006; Morrison and Brown, 2004), the prioritization of the project interests to manage the conflicts (Verma, 1997) and the willing to negotiate (Denison et al, 2006; Schmitz et al., 2014) are recognized as cultural characteristics which allows the adaptation of stakeholders to solve problems (Ariza Aguilera, 2018). In consequence, the following hypothesis is formulated:

Hypothesis 8 (H8): There is a positive and significant relation between the adaptation for problem resolution and the management effectiveness of IT projects

RESEARCH METHODOLOGY

Research Design

A non-experimental, descriptive and correlational research was chosen for this empirical investigation. The study corresponds to a non-experimental design because the variables were not manipulated. Besides, the research design is descriptive and correlational because it is aimed to determine the perception of the participants about the variables and discover the relations among the cultural categories of the model and the indicators regarding project management effectiveness (Hernández, Fernández and Baptista, 2014).

A quantitative study was carried out in which a survey was used to collect the information. The survey included forty-three items, of which thirty-two items measured organizational culture and eleven items were related to project management effectiveness. In order to measure culture, a diagnostic instrument derived from a model of organizational culture in project environment proposed by Ariza Aguilera (2018) was used. It is composed of thirty-two items. Finally, a construct built by Ariza (2017) was used to measure the effectiveness of project management. It is comprised of eleven indicators distributed in three dimensions: (1) compliance with stakeholder expectations, (2) team satisfaction and (3) achievement of commitments. Figure 3 presents the research model.

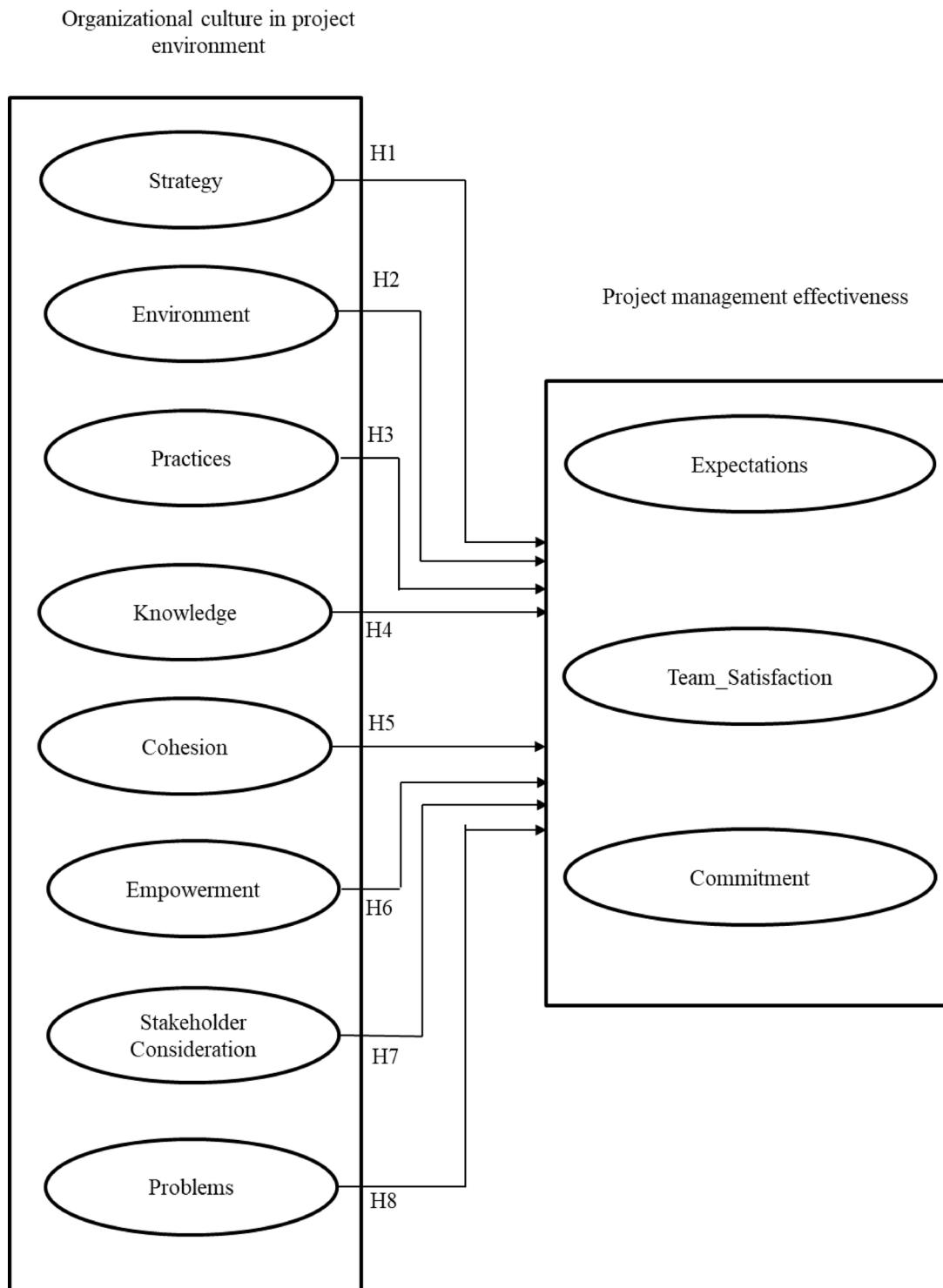
Sampling and Data Collection

The population defined for the study consisted of 200 professionals, active members of the Colombian association of system engineers (Asociación Colombiana de Ingenieros de Sistemas -ACIS). The association is a non-profit organization that has been in force since 1975 and that represents the guild of IT professionals in Colombia. A simple random sampling was applied for finite populations. An expected sample of 132 companies was determined, with a confidence level of 95% and a sampling error of 5%. The response of 136 private organizations from different economic sectors located in Bogotá, Colombia was obtained, achieving the expected coverage. The respondents were leaders and team members of IT projects. The information was collected between June and September 2016. The surveys were completed online. Confidentiality and anonymity were guaranteed to the respondents. The data was checked to identify whether some surveys proceed from the same organization or not. It was confirmed that the 136 records belonged to different organizations.

To characterize the respondents, the information corresponding to role in projects, years of work in the organization and age were collected. With respect to the role in projects, 68% corresponded to project leaders and the remaining 32% to team members. With regard to years of work, 43% had been working for more than 5 years, 36% less than 3 years and 21% between 3 to 5 years. Regarding the age range, 68% were between 30 and 50 years old, 17% were under 30 years old and 22% were over 50 years old.

Information was requested related to the structure of the organization, the existence of a quality certification and the economic sector. With respect to structure, 58% were functional, 20% projectized and 12% matrix. Related to the existence of a quality certification, 66% had a quality certification and the remaining 34% do not. Finally, regarding the economic sector, 32% corresponded to the information technology sector, 10% to the services sector, 14% to the financial sector, 12% to education and the remaining 23% to other sectors of the industry.

Figure 3. Research model



Measures

The unit of analysis was the organization. The research focused on the assessment of cultural characteristics of the organization and its effectiveness in project management. The statistical techniques included for model validation were applied using the Statistical Package for Social Sciences for Windows SPSS and AMOS version 26.

The reliability and validity of the data was tested using the alpha of Cronbach and the factor analysis respectively. To validate the degree of integrity of the culture model and the construct of project management effectiveness, it was carried out a Confirmatory Factor Analysis (CFA). The estimation method was Maximum Likelihood (ML). A Structural Equation Modelling (SEM) was used in order to establish the relations between organizational culture and project management effectiveness.

RESULTS AND DISCUSSION

The normality of the data was reviewed by means of the Kolmogorov-Smirnov test. For all variables included in the study at the individual level, the level of significance was less than 0.05 ($p < 0.05$), indicating that the sample did not have a normal distribution. Additionally, the asymmetry and kurtosis indicators showed values different from 0, confirming this statement (Hair et al., 2010).

Reliability of the Instrument

The reliability of the instrument was verified by determining individual item reliability, internal consistency, convergent validity and discriminant validity.

Individual item reliability and internal consistency was verified by means of the Cronbach's Alpha indicator, which showed a result of 0.97 for the items associated with the organizational culture model and 0.94 for eleven indicators of the project management effectiveness construct. The results confirmed that the instrument has internal consistency considering the threshold of 0.70 for social sciences proposed by Hair, Black, Barry and Anderson (2010). With respect to the individual item reliability, the results did not evidence the necessity of eliminating any item in order to increase the Cronbach's Alpha indicator.

The convergent validity of the instrument was determined by using the Bartlett's sphericity test. The significance index of the test has a value between 0 and 1. If the index is less than 0.05, the existence of significant correlations among components of the model is corroborated (Bartlett, 1950). In this case, the significance index was 0.000 both in the level of categories for the culture model and dimensions of the effectiveness.

The discriminant validity was verified by using the Kaiser-Meyer-Olkin (KMO) Test which allows identifying whether independence exists among groups of variables or not. The value of the indicator is between 0 and 1. Values less than 0.05 confirm lack of independence among components of the instrument (Kaiser, 1981). In this case, the indicator was 0.942 for categories of the culture model and 0.674 for dimensions of the effectiveness.

Validity of the Research Model

To validate the degree of integrity of the research model, a Confirmatory Factor Analysis (CFA) was conducted. The estimation method was Maximum Likelihood (ML). The factorial structure was analyzed using the standardized estimates shown by AMOS, given the absence of normality of data. Standardized estimators correspond to factors loads which represent the strength of the association among the latent variables and the observed variables related to the perception of the respondents (Hair et al., 2010).

Initially, a first order factor model consists of thirty-two variables of organizational culture and eleven indicators of project management effectiveness (Model 1) was analyzed. The grouping of the variables of Model 1 correspond to the distribution originally proposed by Ariza Aguilera (2018) and Ariza (2017). The thirty-two variables were grouped into eight categories and the eleven indicators into three dimensions (Figure 4).

According to Hair et al. (2010), factor loads greater than or equal to 0.50 and less than 0.70, are considered to have a practical significance and loads greater than or equal to 0.70 are considered indicative of a well-defined structure and have statistical significance. In Model 1, only the item related to compliance of schedule of the project management effectiveness construct exhibited a factorial load under 0.5.

For other part, the goodness of fit indicators was not in the range specified by Hooper et al. (2008), evidencing a poor fit. In a step-by-step procedure, Model 1 was adjusted until good fit indicators were reached. Model 2 was comprised of seven additional associations among some variables of the model, seven variables were eliminated and two new relations were created (Figure 5).

The new associations in Model 2 were created as follows: (1) Between ApTerms and APDocument, (2) CoLessons and CoIdeas, (3) CoSCoordination and CoSLeader, (4) SOpinion and SExternal, (5) Scope and Stra, (6) Requerements and Stra and (7) Budget and Schedule.

Model 2 was made up of thirty-eight observed variables. The eliminated variables in Model 2 were:

- (1) AEportfolio: Objective criteria are used with respect to projects in the portfolio.
- (2) AChanges: Flexibility of the organization with the changes in the projects.
- (3) CoInterchange: Interchange of information among team members.
- (4) CosVision: Common vision regarding the objectives of the projects among organization members.
- (5) EAuthority: Respect to authority of project leader.
- (6) SNeed: Attention to the necessities of the stakeholders.
- (7) Quality: Compliance with the quality of the projects.

Two new relations were created in Model 2:

- (1) Between strategic alignment of projects (Strategy) and the variable named ApPolitics (Understanding and following of policies and guidelines regarding the project management) and
- (2) Between cultural category named as strategic alignment of projects (Strategy) and the variable named EDelegation (Delegation of decision-making on team members).

With the change, Model 2 exhibited good fit indicators. Table 1 details fit indicators for Model 1 and Model 2.

Figure 4. Confirmatory factor analysis for model 1

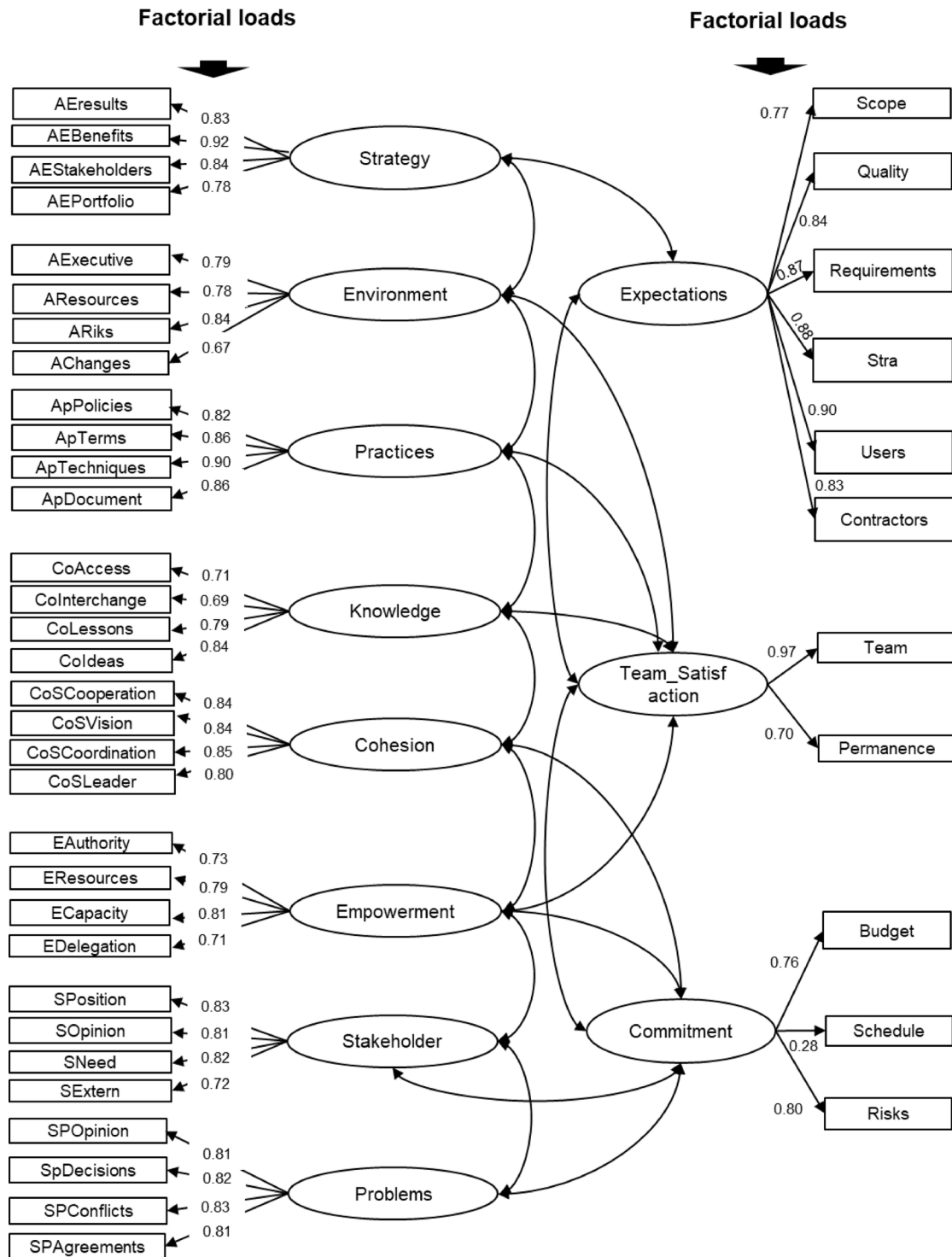
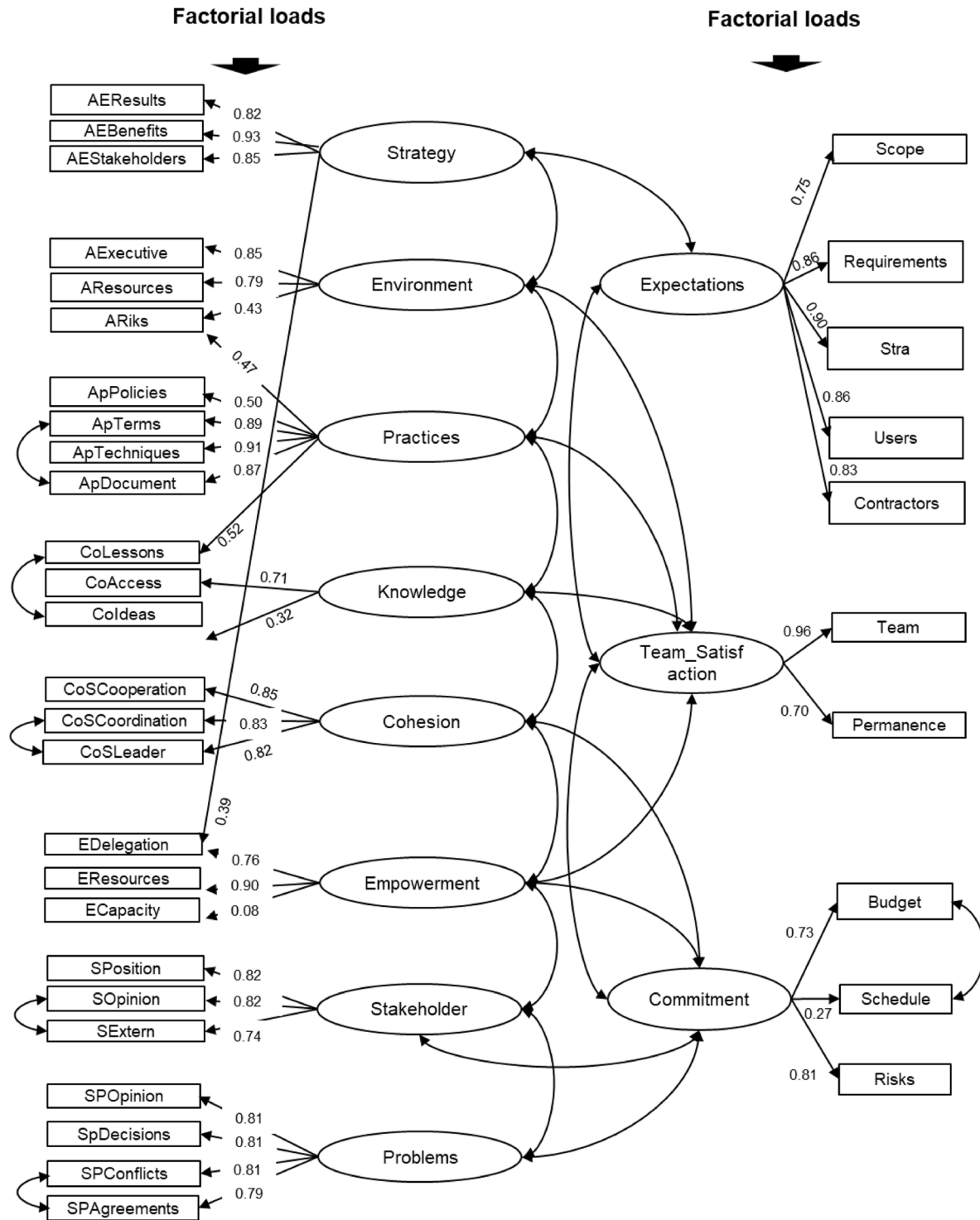


Figure 5. Confirmatory factor analysis for model 2
Source. Own elaboration.



Relation between the Organizational Culture and the Project Management Effectiveness

Taking as reference the Model 2 which has a good fit, a structural equation modelling was carried out with the aim of establishing the possible relations among categories of the organizational culture and dimensions of project management effectiveness. A Model 3 was generated in AMOS by drawing all the possible relations between cultural categories and dimensions of effectiveness. However, the p-value for the regression weights only was significant for the relations between Strategy and Expectations, Cohesion and Team_Satisfaction, Empowerment and Commitment, Stakeholder and Expectations, Problems and Expectations, Problems and Team_Satisfaction and Problems and Problems and Commitment (Figure 6).

The regression weights evidenced that the strategic alignment of projects have incidence on the dimension named as compliance with expectations; but there is no incidence of this category on the other dimensions of the project management effectiveness. In consequence, the hypothesis one is confirmed partially at the level of 95%. This can be explained due to the outcomes of the projects which are aligned to the strategy generate benefits for different stakeholders like clients, users or contractors. Indeed, the satisfaction of these stakeholders are related with the compliance of their necessities (Heerkens, 2001; Shenhar et al., 2001).

The findings showed an incidence of the cohesion among stakeholders on team satisfaction exclusively. It can be deduced that the cooperation among different areas of organization, the facility for coordinating their resources as support to the projects and the recognition of the authority of project leaders by the functional areas predict the team satisfaction. Therefore, the hypothesis five is confirmed partially at a level of 95%. The result can be compared with the findings of Chin Gu et al. (2014) which showed low and positive correlations among the project success and the institutional collectivism. Even though the study of Ching Gu et al. (2014) did not report a relation of dependence, the positive relation between project success and the grade in which the organization reinforces the collective actions was established.

The incidence of the empowerment on the achievement of commitments was found according to the p-value of regression weight which was less than 0.05 ($p = 0.040$). This result allows to confirm the hypothesis six partially at the level of 95%. It can be deduced that to the extent that the organization provides the resources and develop the capacities of the stakeholders, the compliance with budget, schedule and the response to the risks have better chance. While Seibert et al. (2004) found a moderate correlation between empowerment and team satisfaction, this study did not determine any incidence of empowerment on the satisfaction of the team.

It was found that the consideration of stakeholders is a cultural category that has incidence on the compliance with stakeholder expectations but non incidence on the team satisfaction and the achieve-

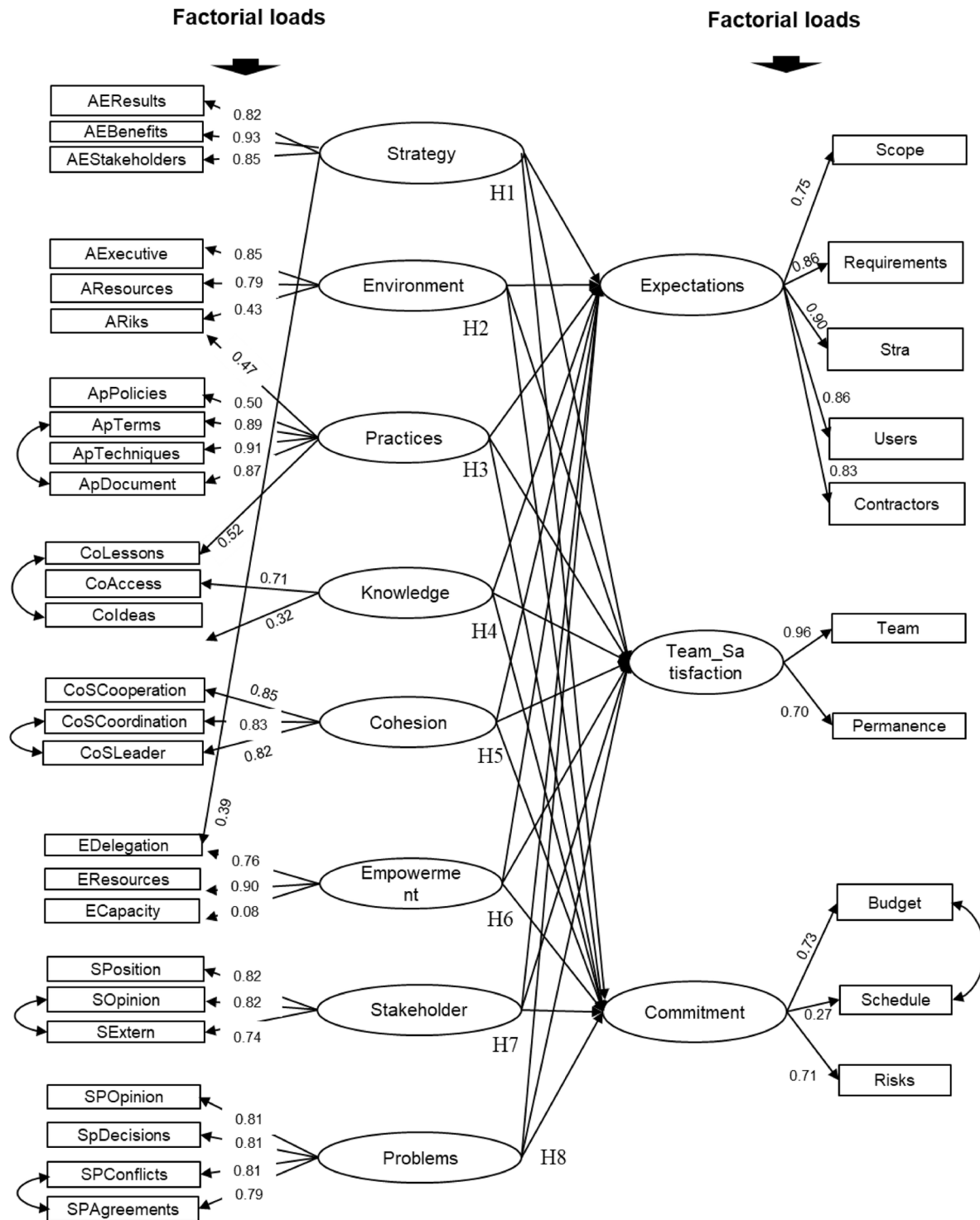
Table 1. Goodness of fit indicators for Model 1 and Model 2

Goodness of fit indicators	NFI	CFI	RMSEA
Minimum values for a good fit	Greater than 0.80	Greater than 0.90	Less than 0.08
Model 1	0.739	0.838	0.092
Model 2	0.824	0.916	0.073

Source. Own elaboration.

Figure 6. Proposed relations of dependence among organizational culture and project management effectiveness (Model 3)

Source. Own Elaboration.



ment of commitments. Therefore, the hypothesis seven is confirmed partially at the level of 95%. This result can be explained because the achievement of expectations is a dimension built on the base that the satisfaction of the different stakeholders with projects is derived of the grade in which their requirements are cover and the outcomes of the projects are the ones need by them.

The hypothesis eight was confirmed totally at the level of 95% because there was evidenced the incidence of the adaptation of problem resolution on each dimension of project management effectiveness. In this case, it can be deduced that the accomplishment of commitments of the projects, the achievement of the expectations of the stakeholders and team satisfaction can be reached in the extent that the stakeholders are disposal to listen the other opinions, negotiate and do agreements with the objective to overpass obstacles and problems in projects.

Finally, there is non-evidence of dependence among project management effectiveness and cultural categories like understanding of the project environment, adoption of project management practices and valuation of the knowledge associated with projects. While Milosevic and Patanakul (2005) found moderate correlations between the standardization of project management practices and the project success, in this study it was not found dependence between the two variables. In consequence, the hypotheses two, three and four are rejected. These results contradict the finding of Janz and Pattarawan (2003) in which the level of learning of the team members increases their satisfaction. The final model (Model 4) is presented in Figure 7.

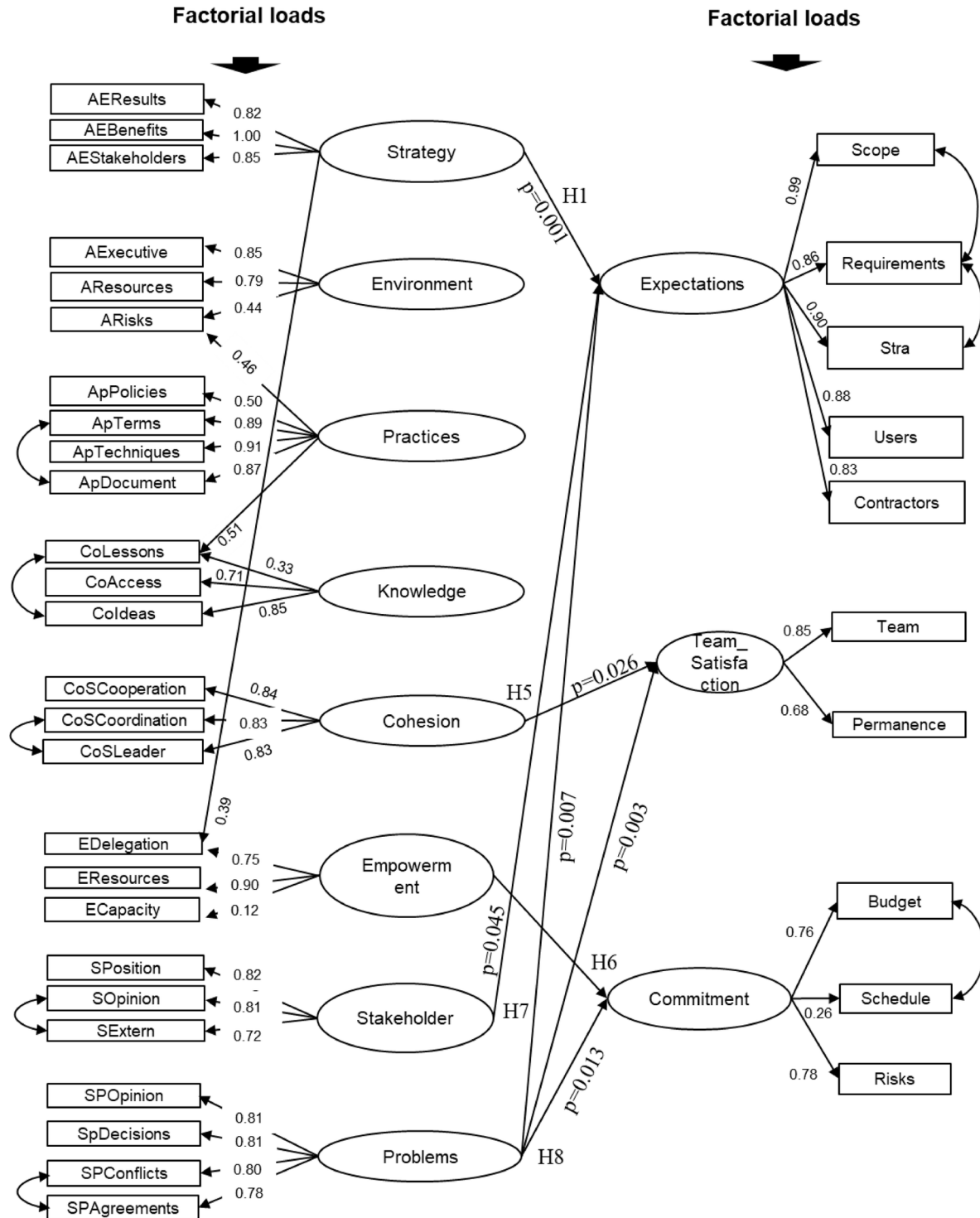
In consequence, the obtained results evidenced that the flaws detected in IT projects by Nelson (2007), such as the difficulty in solving problems at the individual or team level and the lack of involvement of the end users become the cultural aspects which have incidence in the project management effectiveness. This study reinforces the need of not only to enhance the adaptation of stakeholders to solve the problems and their consideration during the execution of the IT projects, but aligning their results with the strategy. In the same way, the level of cohesion among stakeholders influences the team satisfaction. The Appendix presents the scale with the items and names of each variable (Table 2).

FUTURE RESEARCH DIRECTIONS

Identifying specific aspect of the different groups can allow the development of frameworks and methodologies which contribute to project effectiveness (Tsiga et al., 2016). Future research can culturally characterize economic sectors or groups in project context by means of the proposed instruments.

A limitation of the present research was the inclusion of leaders and team members exclusively. It is recommended that future research involves other stakeholders from the same organization. A bias could be presented related to the assessment of culture in each organization, since only one participant per organization completed the survey. Further studies may include more participants in each organization. Additionally, it was analyzed the first order factor structure of the model. It is encouraged that future research use the proposed instrument with a greater number of participants and the examination of the second order factor structure is carry out.

Figure 7. Relations of dependence among organizational culture and project management effectiveness (Model 4-Final)



CONCLUSION

Some of the empirical studies about IT projects carried out so far have identified cultural factors related to the project success without conclusive results. The objective of the present research was to establish the incidence of the organizational culture on the management effectiveness of IT projects. An organizational culture model and a construct of project management effectiveness proposed by Ariza Aguilera (2018) and Ariza (2017) respectively, were used to build an instrument whose reliability was demonstrated.

A Confirmatory Factor Analysis (CFA) was applied to validate the model. The initial model (Model 1) composed of forty-three variables did not fit adequately. For this reason, in a step-by-step procedure, a second model (Model 2) was adjusted until good fit indicators were reached. The Model 2 was made up of thirty-eight variables. A structural equation modelling (SEM) was used to generate a third model (Model 3) which allows to establish the relations between organizational culture and project management effectiveness. A final model (Model 4) evidenced four cultural categories which influence the project management effectiveness: (1) strategic alignment of projects, (2) cohesion among stakeholders, (3) empowerment and (4) adaptation for problem resolution.

The research question looked for determining the incidence of the organizational culture valued by leaders and team members on the management effectiveness of IT projects. The response to this question is framed by four findings. The first finding corresponds to the incidence of the strategic alignment of projects on the compliance of expectations. The second finding is related to the incidence of the cohesion among stakeholders on the team satisfaction. The third finding is regarding the incidence of empowerment on the achievement of commitment. Lastly, the fourth finding indicated that the adaptation for problem resolution have incidence on the project management effectiveness, so the compliance of expectations, the team satisfaction and the achievement of commitment are variables which can be predicted from this cultural category.

Therefore, there are a relation of dependence among the adaptation for problem resolution and the management effectiveness of IT projects. It was determined that the management effectiveness of IT projects depends on the adaptation of the stakeholders to solve the problems, in a context with restrictions. To the extent that the opinion of stakeholders is considered, timely decisions are taken, the interests of the project prevail to resolve conflicts and the negotiation is promoted to reach agreements, the management effectiveness of IT projects can increase.

The findings can be compared with other previous studies. The research of Ching Gu et al. (2014) determined a positive relation between project success and the grade in which the organization reinforces the collective actions was established. This result is confirmed by the dependence found between the cohesion among stakeholders and team satisfaction, one dimension of the project management effectiveness. In the other hand, Seibert et al. (2004) found a moderate correlation between empowerment and performance of the project team. The results did not evidence of any incidence of empowerment on the satisfaction of the team. Moreover, Milosevic and Patanakul (2005) found moderate correlations between the standardization of project management practices and the project success. Nevertheless, in this study it was not found dependence between the adoption of project management practices and any dimension of the project management effectiveness.

In the present study, the participants did the valuation of the project management effectiveness and the culture in their organizations. In consequence, the dependent and independent variables were evaluated by the same person. Podsakoff, Mackenzie, Lee and Podsakoff (2003) draw attention to a possible bias that may arise in this situation, because people tend to be consistent in their responses or to orga-

nize information consistently. This can generate a bias at the level of correlations among the variables. However, Hernández, Fernández and Baptista (2014) propose that the measurement of variables that will be correlated with each other come from the same participants.

The surveys used in the study belonged to different organizations and they correspond to the valuation of an IT professional exclusively. This situation could generate a bias on the results. For this reason, it is recommended that future research obtain more than one record of the same organization and the data is grouped by organization for the analysis.

The present study extends the theory in project management and information technology. At the practical level, the investigation is a guide to project offices and human resources areas regarding the cultural aspects that should be optimized to improve the project effectiveness.

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KEY TERMS AND DEFINITIONS

Confirmatory Factor Analysis (CFA): A statistical technique that allows to contrast a theoretical model in which the researcher a priori establishes the total set of relationships between the elements that configure it.

Correlation: Statistical technique used to determine the relationship between two or more variables. They take a value between 0 and 1.

Factorial Loads: Statistical estimates that indicate the strength of association between two variables. They take a value between 0 and 1.

Linear Regression: A mathematical model used to determine the dependency relationship between a dependent variable and one or more independent variables. It also allows to identify the degree to which a dependent variable can be predicted by the independent variables.

Maximum Likelihood: It is a method of estimating parameters of a model that shows the best way to describe the degree to which the real data is being represented by the model.

Reliability: Degree in which a set of items measures the same concept.

Structural Equations Modeling (SEM): A statistical technique that allows to validate the existence of relationships between dependent and independent variables.

Validity: Level of correspondence among a model or a structure and the real data. Measurement to determine whether a model or a structure accurately measures what it is intended to measure.

APPENDIX

Table 2. Scale for assessment of organizational culture and project management effectiveness 1

No.	Variable name	Item
Strategic Alignment of Projects		
1	AEResults	The organization seeks that the results of the projects support the fulfillment of its strategy.
2	AEBenefits	The benefits that the projects bring are clearly identified by the stakeholders.
3	AESTakeholders	Decisions are made taking into account the greatest benefit for project stakeholders.
4	AEPortfolio	The decisions that the organization makes with respect to new and active projects, obey objective criteria within the framework of the strategy.
Understanding of Project Environment		
5	AEjecutive	The executive levels of the organization are interested in the projects and participate in the processes and activities required for their management.
6	AResources	The organization is committed to provide the time and resources necessary for the management and development of the projects.
7	ARisks	The organization is aware that projects individually and together have associated risks and promote actions to manage these risks.
8	AChanges	The organization is flexible in the face of the changes required by the projects in order to achieve the proposed objectives.
Adoption of Project Management Practices		
9	ApPolicies	The policies and guidelines regarding the management of the projects are understood and followed by all.
10	ApTerms	The organization has ensured the diffusion and standardization of project management terminology.
11	ApTechniques	People consistently use the procedures, tools and techniques that the organization has prepared for project management.
12	ApDocument	Team members accept and follow the rules regarding the documentation of the projects.
Valuation of Knowledge Associated with Projects		
13	CoAccess	The organization facilitates access to information that may be useful to improve the project development.
14	CoInterchange	People are willing to share and exchange information they have, in order to solve a problem or make a decision on projects.
15	CoLessons	The organization records the failures of the projects so as not to repeat them in the future or records good practices to replicate them.
16	CoIdeas	The organization promotes the generation of ideas in the projects to solve problems or improve the way of doing things.
Cohesion Among Stakeholders		
17	CoSCooperation	The areas of the organization which participate in a project cooperate and provide the support to realize it.
18	CoSVision	People from different areas of the organization share a common vision regarding the objectives of the projects.
19	CoSCoordination	The organization facilitates the coordination of project tasks among the different groups or areas which comprise it.
20	CoSLeader	People from different areas follow the instructions and direction given by the leaders who are assigned to the projects.
Empowerment		
21	EAuthority	The organization makes sure to give the necessary authority to the project leaders and promote the respect of all for them.
22	EResources	Project leaders and team members can easily access and use the assigned resources.
23	ECapacity	The organization makes sure to provide the knowledge and develop the skills required by the team members for the execution and management of the projects.
24	EDelegation	The existing levels of authority in the organization delegate the decision-making on team members within the limits of their responsibilities.
Consideration of Project Stakeholders		
25	SPosition	The organization promotes the analysis and understanding of the position of the stakeholders in relation to the projects and their degree of interest or disinterest in them.
26	SOpinion	People who may be affected by the projects are always consulted and their opinion are taking into account in the decision-making.
27	SNeed	People in projects seek to understand the needs of stakeholders and define the requirements according to these needs.
28	SExtern	External stakeholders (suppliers, contractors, customers) are considered allies in the projects and are treated as such.

continued on following page

Incidence of Organizational Culture on Management Effectiveness of IT Projects

Table 2. Continued

No.	Variable name	Item
Adaptation for Problem Resolution		
29	SPOpinion	The organization reinforces the fact that people express their opinions openly to reach agreements on projects.
30	SpDecisions	Stakeholders take actions to solve projects problems quickly in order to move forward.
31	SpConflicts	A collective position is assumed when there are conflicts in the projects, according to the interests of the project.
32	SpAgreements	Project stakeholders have the willing to negotiate with each other and achieve the required agreements.
33	Scope	In the organization, the scope defined for the projects is met.
36	Quality	The products or results of the projects have the quality expected by the organization.
37	Requirements	Projects are characterized by meeting the requirements of stakeholders or interest groups.
39	Stra	Projects enable the fulfillment of strategic objectives of the organization.
40	Users	The users and / or clients feel satisfied with the results of the projects.
42	Contractors	The development of the projects allows creating a sustainable relationship between the organization and the suppliers and contractors.
Satisfaction of the project team		
41	Team	The team members are satisfied with their participation in the projects.
43	Permanence	The permanence of people in the teams is maintained during the development of the projects.
Achievement of commitments		
34	Budget	In the organization, the estimated budget for the projects is met.
35	Schedule	The projects that are developed in the organization meet the schedules that are estimated for their realization.
38	Risks	The responses given to risks are appropriate.

Chapter 5

Model P3S–VB: Selection of Project and Program Portfolios Based on Value

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ABSTRACT

This chapter describes and details the P3S-VB model: the Selection of Projects and Programs Portfolio Based on Value. The P3S-VB contributes to the discipline of project management and portfolios, in the definition of the constructs of an appropriate level of incorporation of capabilities, value and technology; identification of the range in which technological capabilities, projects and portfolios can create value; the processes for selecting the portfolio of projects based on value; and the alignment of benefit management and project management. The model was designed keeping the rigor of scientific research, following as a reference the DSR-IS science design method, with a focus on practical applicability.

INTRODUCTION

The strategy is the coupling that the company performs between its internal resources and capabilities, its response to the opportunities and risks of the external environment of the company (Grant, 1991), and the creation of value (Lepak, Smith & Taylor, 2007; Normann & Ramirez, 1998). The strategy aims to identify the investments required to maintain, develop, incorporate and extend the resources and capabilities required by the company to achieve long-term sustainability (Chung et al., 2016; Helfat & Winter, 2011) (López-Cabarcos, Göttling-Oliveira-Monteiro, & Vázquez-Rodríguez, 2015; Maniak et al., 2014; Teece, Pisano & Shuen, 1997; Winter, 2008). For which, the successful implementation of the strategy is achieved when the delivery of value to the stakeholders is maximized, balancing the risks, and optimizing the use of the resources required to achieve it (Costantino, Di Gravio, & Nonino, 2015). Despite this, organizations, on average, only reach 63% of the promised financial return on their strategies, and in 66% of the companies the strategy is never executed (Johnson, 2004; Kaplan & Norton, 2008; Mankins & Steele, 2005).

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The project portfolio as a strategic tool contributes to the development of business goals and objectives (Vitolo & Cipparrone, 2014). The main component of this purpose is the Selection of Portfolio Projects PPS, maximizing the balance between resources, risks, capabilities, and value to be created (APM, 2006; IPMA, 2006; Kodukula, 2014; PMAJ, 2005; PMI, 2017b; Turner, 2008). PPS has been studied at the academic, business and industrial levels (Archer & Ghasemzadeh, 1999; Artto et al., 2008; Bonham, 2005; Cooper, Edgett, & Kleinschmidt, 2001; Crawford & Cooke-Davies, 2012; Dickinson, Thornton & Graves, 2001; Ginzberg, 1979; Henriksen & Traynor, 1999; Huang et al., 2015; Kundisch & Meier, 2011; Levine, 2005; OGC, 2011; Patanakul, Curtis, & Koppel, 2013; PMI, 2017b).

There is evidence of the positive contribution of PPS practices in the alignment of the portfolio with the purposes, objectives and strategies of the companies, both for the incorporation of organizational capabilities and in the development of competitive advantages (Buschle & Quartel, 2011; Chiang & Nunez, 2013; Kaiser, El Arbi, & Ahlemann, 2015; Maes, De Haes, & Van Grembergen, 2015; Say, Fusfeld & Parish, 2003; Too & Weaver, 2014; Voss & Kock, 2013). However, the literature on portfolio management and PPS has paid little attention to value management concepts (Martinsuo & Killen, 2014). In the last decade, increased research, from academia and industry, proposes the need to broaden the definitions of value in the portfolio (Augusto Oliveira et al., 2010; Bolsinger, Bewernik, & Buhl, 2011; Kopmann et al., 2015; Winter & Szczepanek, 2008).

Value can be interpreted as a force that governs our behavior or as a permanent property of goods and services (Iyer, 2009; Parkin & Esquivel, 2010; Stewart, 2010). This can be said to focus value on the people, stakeholders or interest groups, and the goods or services they want. This is how the creation of value in the company involves being efficient and effective in: (a) selection of changes or capacities to be developed (Archer & Ghasemzadeh, 1999); (b) allocation of resources (Markowitz, 1991); (c) management of benefits and impacts to be incorporated (Beringer, Jonas, & Kock, 2013; Jenner, 2014; OGC, 2010); and (d) management of stakeholder expectations (Kaiser et al., 2015).

Research by Forstner, Kamprath, and Röglinger (2014), Linhart et al. (2015) and Afflerbach, Bolsinger & Röglinger (2016), conclude that despite the contribution of capabilities in the development of strategic and organizational objectives, the development of capacity at the highest level does not necessarily contribute to maximizing the value potential to be created for the company. The above situation applied to the context of IT and DT Digital Transformation projects entails the risk of misallocation of economic and non-economic resources (Forstner et al., 2014). In turn, the vast majority of IT projects require the allocation of resources for a minimum set of technical capabilities, from which the planned benefits can be generated from the portfolio (Bonham, 2005). If it is not possible to develop that minimum level of capabilities, such projects will not add value. Thus, in PPS it is crucial to identify the range in which projects create value, the level of development associated with the different capacities to be incorporated and the resources involved for the different scenarios.

The foregoing, from the purpose of the research underlying this chapter confirms that there are important gaps in which research in value in the PPS can contribute to identifying the right projects and portfolios for the organization. These should be characterized by incorporating the right capabilities, at the right technological level, for the right stakeholder groups, at the right time, and that all of this is appropriated in the company in such a way that value is created and captured (Letavec, 2014; Melville, Kraemer, & Gurbaxani, 2004; Serra, 2016; Ward & Daniel, 2012).

The P3S-VB Value-Based Program and Project Portfolio Selection model is this chapter's contribution to the above issues. Its purpose is to support decision making in the selection of the portfolio of IT and

Model P3S-VB

DT projects, through value management. This model was developed, using as a reference the science design methodology, Design Science Research, or DSR-IS (Vaishnavi & Kuechler, 2015).

The P3S-VB model is intended to contribute proposals to the basic research question below:

Q0. How to contribute to the selection of the portfolio of IT and TD projects, giving priority to the development of the appropriate level of value that each of the technical capabilities of the scope proposes to incorporate?

In line with the purposes underlying this research and as a result of the literature review, the following hypotheses were put forward to validate the design fundamentals of the P3S-VB model.

H1. The required level of technical skills to be developed by IT and DT is directly associated with the creation of value in the case of project business.

H2. Investment in the development of technical capabilities, above an appropriate level for the organization, does not necessarily increase the value created by IT and DT projects.

The hypotheses of the investigation that supports this chapter were confirmed through three information banks, described above, and applying different statistical techniques such as, T-Student for equality of averages, Levine for equality of variances, T3-Dunnett, ANOVA, and coefficient of Pearson. The validation of the hypotheses of this investigation confirmed that the P3S-VB model contributes with value creation & capture to organizations. This, as recognized by the panel of experts, is due to the orientation to the value that each of the four processes have. As well as in the purposes and contribution provided by the constructs of the appropriate level of incorporation of capacities, value, and technology.

It was confirmed that the required level of digital and technical capabilities to be developed by IT is directly associated with the creation of value in project business case. Likewise, the percentage of planned benefits that are transformed into captured value increases significantly (65.16%) as project planning is aligned to impacts on capabilities, processes, and business objectives, and by the incorporation of key value indicators to measure these impacts in terms of business.

The design of the model to Selection of Projects and Programs Portfolio Based on Value P3S-VB applied concepts, findings, validations, and definitions achieved from critical review of the literature, the recommendations from experts consulted were documented during the construction of “artifacts” (or intermediates research products), and the observations, results, and conclusions of the practical application of the model and the corresponding validation were incorporated.

This model is described from a graphic representation. Which is complemented by the explanation of the characteristics that underlie the definition of new constructs, and the explanation of the structural aspects that allow its use in Projects Portfolio Selection – PPS associated with Information Technology IT and Digital Transformation DT.

The P3S-VB model is based on five principles: (a) value orientation; (b) the portfolio as a strategic tool; (c) the business capabilities and the value potential to be created; (d) digital and technological capabilities on value creation; and (e) stakeholders management and value capture. The purpose of P3S-VB is to potentiate value creation in the PPS, in each of the following processes: organizational alignment; alignment of technological development; selection of IT & DT projects; and value creation & capture.

To achieve the purposes of identification, creation, management and capture of value, in each of the processes indicated, P3S-VB model uses five support tools: (a) analysis of stakeholders benefits per-

ception; (b) IT & DT benefits management cycle; (c) identification the Level of Value to create LoV, the Appropriated Level of Technology to Incorporated ALoTI and the Appropriated Level of Value to Incorporated ALoVI; (d) diamond to maximize the value potential of the IT & DT portfolio; and (e) an objective function and prioritization algorithm of the IT & DT portfolio.

P3S-VB model application contributed to prove that investment in the development of technical capabilities, above an appropriate level for the organization, does not increase the value created by IT & DT projects. In addition, it was concluded that there is a range in which projects and the portfolio create and capture value. This range is related to the differential contribution of value of each of the capabilities to be incorporated in projects. Therefore, model application in a practical case, allowed to conclude that P3S-VB creates value for the portfolio in two ways: The first is associated with the resources of the portfolio that are optimized, by avoiding investments in capacities that do not add value. And, the second is related to the identification of projects in the range of value creation, with which the total value to be created at project level and therefore portfolio is widened.

This chapter is organized in five sections. The first section summarizes the background, review of related literature, and the rationale for what is presented here. The second section presents the research methodology used. The third section describes the P3S-VB model, with its principles, processes, and tools. The fourth section focuses on the application of the model in the selection and selection of the portfolio of a company in Colombia. And, in the fifth section is dedicated to the conclusions and future lines of research derived from this.

BACKGROUND

According to Meskendahl (2010), Morris and Jamieson (2005) and Müller, Martinsuo, and Blomquist (2008), organizations materialize their strategy by incorporating changes in their organizational capabilities. Which are implemented through projects, programs, and portfolios (Shenhar et al., 2001). The projects as fundamental pieces in the materialization of the strategy, and aligned to the development of organizational capabilities, contribute to the competitive advantages (Kerzner, 2010). However, the reality of project management, with greater strength each time, shows that the perceived success of the project is not achieved only with compliance in time, cost, and scope. But, the identification, creation, delivery and capture of value is fundamental (Mir & Pinnington, 2014), both for the stakeholders, as for the company (Winter et al., 2006).

The changes, improvements, and positive impacts that are obtained from the use of a good or service, represent the benefits. In other words, stakeholders will find usefulness, associated with the use of the incorporated changes, when they provide them with a greater degree of satisfaction than they obtain or would obtain from the resources they deliver to access those impacts.

Value is present in all evaluations (conscious or unconscious) carried out by stakeholders. When the stakeholder uses the changes and finds utility in them, the benefits are generated, and the use value is identified. When the stakeholder recognizes or provides resources to access the use of those changes, the exchange value is identified. And, when that exchange value is higher than the market value, it is said that value has been generated and created for those who invested in their development. It is important to reaffirm that benefits do not arise autonomously or spontaneously. Therefore, the identification, knowledge, evaluation, and management of stakeholders is a key factor in generating benefits and creating value. As well as the alignment of organizational changes and capabilities to strategic and business objectives.

On the other hand, from the analysis of strategy in organizations, it is concluded that although the objective is to identify the investments required to maintain, develop, incorporate and extend the resources and capabilities required by the company to achieve long-term sustainability (Chung et al., 2016; Helfat & Winter, 2011; López-Cabarcos et al., 2015; Maniak et al., 2014; Teece et al., 1997; Winter, 2008). In reality, organizations, on average, only reach 63% of the financial performance promised in their strategies, and in 66% of companies the strategy is never executed (Johnson, 2004; Kaplan & Norton, 2008; Mankins & Steele, 2005).

In line with Melton, Yates, and Iles-Smith (2007) and Thomas & Mullaly (2008, 2009), it is concluded that this new perspective in project management implies that the management of benefits and the materialization of value in the portfolio are the axes on which the project is directed. Likewise, project success and portfolio performance are significantly affected when benefit management practices are exercised simultaneously (Badewi, 2015; PMI, 2017a; Serra, 2016). At this point and in line with Badewi (2015), it should be noted that in order to leverage the contribution of benefit management to portfolio performance (Kodukula, 2014; PMAJ, 2005), it is required to identify, estimate and manage such impacts throughout the project cycle, from the portfolio selection phase, and during portfolio execution (Chih & Zwikael, 2015; OGC, 2009; PMI, 2017b).

In another order of ideas, it is concluded from the researches of Tallon, Kraemer & Gurbaxani (2000) and Tallon (2007) that companies, in which investments in technological capabilities are more focused on strategic and organizational purposes, achieve greater IT and DT benefits throughout the value chain. It is worth noting here that in the validation of the hypotheses, and particularly in the analysis of the types of benefits in IT projects, Tallon (2007) was confirmed. Therefore, investments in IT and DT, as technological capabilities of the organization, should be structured from the contribution and contribution to business purposes, incorporation or leverage of essential business capabilities, and sources of value creation and capture (Lentz, Gogan, & Henderson, 2002). In summary, from the perspective of the IT and DT projects, the alignment of the objectives of the project scope, to the impacts to be developed in the capacities, processes and business objectives, is a success factor in the generation of the benefits, and creation and capture of the value that the technologies bring to the companies.

The portfolio of projects as a strategic tool contributes to the development of business goals and objectives (Vitolo & Cipparrone, 2014). The main component of this purpose is the selection of the set of projects in the PPS portfolio, maximizing the balance between resources, risks, capacities, and value to be created (APM, 2006; IPMA, 2006; Kodukula, 2014; PMAJ, 2005; PMI, 2017b; Turner, 2008). There is evidence of the positive contribution of PPS practices in the alignment of the portfolio with the purposes, objectives and strategies of the companies, both for the incorporation of organizational capabilities and in the development of competitive advantages (Buschle & Quartel, 2011; Chiang & Nunez, 2013; Kaiser et al., 2015; Maes et al., 2015; Say et al., 2003; Too & Weaver, 2014; Voss & Kock, 2013). However, it is concluded from the review of the literature on portfolio management and as relevant to PPS that little attention has been paid to value management concepts (Martinsuo & Killen, 2014). Therefore, it is concluded that all scientific research that contributes to broaden the orientation of the portfolio to the value, contributes in an important manner in this discipline.

In line with the purposes of identifying the right capabilities for organizations and that the technologies that are incorporated in companies deliver value, it is concluded from the researches of Forstner et al. (2014), Linhart et al. (2015) and Afflerbach et al. (2016), that despite the contribution of capabilities in the development of strategic and organizational objectives, not necessarily the development of a capacity at the highest level, contributes with the maximization of the value potential to be created

for the company. This reality carries the risk that in the PPS, there is a wrong allocation of economic and non-economic resources of the company. On the other hand, it is also concluded from Bonham (2005) research that the vast majority of IT projects require the allocation of resources for a minimum set of technical capabilities, from which the planned benefits can be generated from the portfolio. If the development of such a minimum level of capacity is not possible, such projects do not add value. In synthesis, in the PPS and in the projects, it is determinant to identify the range in which the projects create value, the level of development associated with the different capacities to incorporate, and the resources involved for the different scenarios.

Therefore, from the purposes of this research it is concluded that there are important gaps in which the research in value in the PPS can contribute in the identification of projects and portfolios correct for the organization. Which must be characterized by incorporating the right capabilities, at the right technological level, for the right stakeholder groups, at the right time, and that all of this is appropriated in the company in such a way that value is created and captured (Letavec, 2014; Melville et al., 2004; Serra, 2016; Ward & Daniel, 2012).

The purpose of P3S-VB model is to support decision-making in the selection of the portfolio of IT & DT projects, through value management. For which, and with origin in the preliminary project and understanding of the research problem, an initial prototype was proposed for the structuring of projects and selection of the IT & DT portfolio. Then, and during the exploration of the literature, this research was founded, and because of the findings of the theoretical framework, specific knowledge limitations were identified in the selection of value-oriented IT & DT projects.

The gaps in which limitations were observed were: between the level of development of organizational and technological capabilities; between the value potential to be created and the appropriate level of resources to be allocated; and between the impacts associated with the capabilities to be incorporated, the mechanisms necessary for their measurement, and the capture of value. As such, and in coherence with the DSR-IS methodology, the constructs were developed at the Appropriate Level of Capabilities to Incorporated ALoCI, Appropriate Level of Value to Incorporated ALoVI, and Appropriate Level of Technology to Incorporated ALoTI.

Subsequently, the design of the P3S-VB model was carried out, leveraged in the findings and contributions identified in the theoretical framework; in the new constructs of ALoCI, ALoVI and ALoTI; and, in the confirmation of the three hypotheses defined from the literature review.

The validation of the hypotheses was carried out, through three different sets of information. For the first database, authorization was obtained from the 7 companies in the oil producing sector in Colombia, which represented, by the year 2015, approximately 80% of the total oil production of the nation; these allowed to analyze the planning, execution and ex post evaluation of 413 projects, executed between the years 2010 and 2015; However, for reasons of quality and completeness of the information, only 85 of these projects were used in the validation of the hypotheses. The second database was the result of the application of the P3S-VB model in the selection of the portfolio of 53 projects in a petroleum company in Colombia. The third source of information, and with which the qualitative validation of the P3S-VB model and its components, was achieved applying the expert judgment technique by individual aggregates, to 12 people with high experience in projects, portfolio, and information technologies.

Finally, it must be affirmed that the present investigation extends the opportunity to carry out added studies in the application of the perspective of orientation to value in the direction of projects, direction and selection of the portfolio, design of processes, and management of technology.

RESEARCH METHODOLOGY

According to Vaishnavi and Kuechler (2015), the information technology science design methodology or DSR-IS is a set of synthetic and analytical techniques and perspectives (which complement positivist, interpretative and critical perspectives) for conducting information technology research. The artefacts created with the DSR-IS methodology include, among others, algorithms, human/machine interfaces, models, constructs, system design methodologies and theories applied to the discipline of information technologies.

The objectives of the DSR-IS research methodology are (Peppers et al., 2008): (a) to provide a nominal process for conducting science design research; (b) to build on previous literature on science design, information technologies and associated disciplines; and (c) to provide researchers with a mental model for the structure of research and the achievement of novel results.

Based on these limitations or gaps identified in knowledge, new constructs are defined (Vaishnavi & Kuechler, 2015). According to McCarthy (1980), quoted by Vaishnavi and Kuechler (2015), the identification of new constructs is related to what the researcher learns or discovers, by evaluating things according to theory, or according to the behavior of phenomena in real life.

The following are the gaps in which limitations were observed: between the level of development of organizational and technological capacities; between the value potential to be created and the appropriate level of resources to be allocated; and between the impacts associated with the capacities to be incorporated, the mechanisms necessary for their measurement, and the capture of value.

MODEL P3S-VB

Model P3S-VB for the Value Increase in the IT PPS

Figure 1 presents the process model for IT projects and programs portfolio selection value-based, P3S-VB. It is shown that the model is developed from the constructs of the appropriate level of capabilities, value, and technology to incorporate, ALoCI, ALoVI and ALoTI, respectively. It consists of four processes, is based on five principles, and has five support tools.

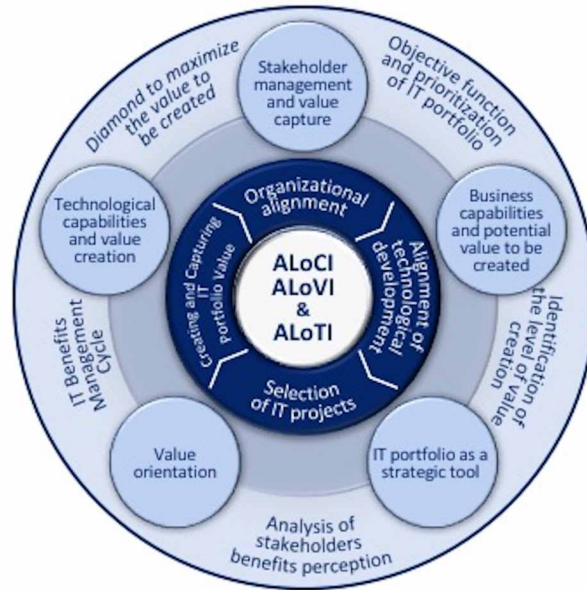
Principles Underlying the P3S-VB Model

The purpose of P3S-VB is to potentiate the creation of value in the selection of the portfolio of IT projects, for which the model is based on the following five principles.

Value Orientation

The value in the P3S-VB model is the additional utility that one or several stakeholders obtain, by exchanging one or several resources that are useful and valuable to them, to access the positive impacts they find and grant the use of goods or services. The potential value to create PVC in the portfolio and for a program or project is the relationship between the benefit or measurable result of a positive perceived change by one or more of the main stakeholders and the resources allocated to obtain them (OGC, 2010).

Figure 1. P3S-VB, processes for projects and programs portfolio selection, based on value
 Source: Malagón-Barinas (2018, p. 227).



Equation 1 allows us to understand that the resources assigned to meet needs and expectations are not only monetary, but technical, human, knowledge and time (Barney, 1991; Nelson & Winter, 1982).

Equation 1. *Definition of potential value to be created*

$$PVC \propto \frac{\sum_{j=1}^m \text{Benefits Generated}_{(\text{Meeting stakeholders needs})}}{\sum_{i=1}^n \text{Resource sused}_{(\text{Tangibles and intangibles})}}$$

where: $i = 1, \dots, n$; all the resources required to achieve all the benefits generated and $j = 1, \dots, m$; these are all the benefits generated from the resources used (Source: Adapted from OGC (2010)).

Equation 1 shows that PVC is not absolute, but relative, and therefore can be estimated in various ways by different interest groups (CEN, 2000; OGC, 2010). Because multiple stakeholders may have different perceptions of what constitutes the satisfaction of their needs (PMI, 2017), as well as different perceptions of the use value of the results and changes introduced by the project. Thus, equation 1 includes the sum of the benefits generated from the perspectives of all stakeholders.

It should be clarified that PVC at programs and projects level does not necessarily imply value capture. This is because, among other reasons, whoever creates an increase in value may or may not be able to capture or retain the value in the long term. In which case, the PPS must define, according to the criteria applied by the company in the conformation of the portfolio, if it is viable or not to deliver resources to the project, even if it is not feasible to capture value.

IT Portfolio as a Strategic Tool

Among the causes of poor performance of unsuccessful projects (mainly large projects), significant gaps are identified between the project plan and the objectives of the business strategy (Shenhar et al., 2007; The Standish Group, 2013). This misalignment implies a relevant challenge in the purpose of value creation.

Figure 2 illustrates the different components of the portfolio. This illustration shows how these components are articulated in order to close the gaps between the current situation and the strategic and organizational objectives (Daniel, Ward, & Franken, 2014). In this closing of gaps, new capacities are enabled or changes in existing capacities are promoted to generate benefits and create value.

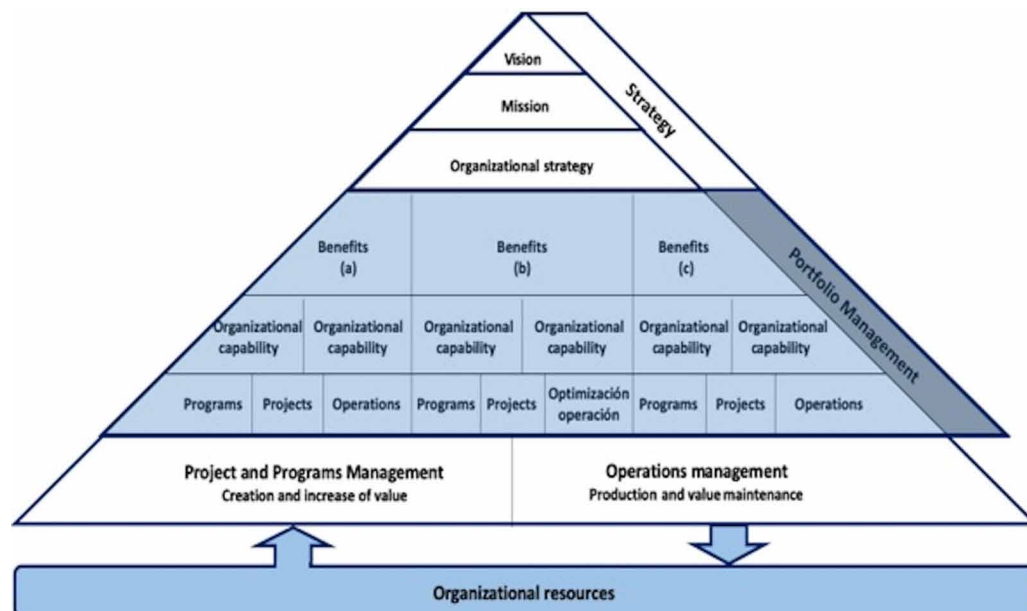
In addition, figure 2 indicates that the benefits generated are a consequence of the positive impacts incorporated in one or several organizational capacities (Teece, 2016), and contribute to the materialization of the strategic objectives. Likewise, the benefits will only be “produced”¹ through the use and exploitation given by one or several stakeholders (Zwikael & Smyrk, 2011). It is during normal business operation that profits are generated (Lepak, Smith, & Taylor, 2007). Thus, operations management is responsible for ensuring the sustainability of benefits and capturing the value created from the management of programs and projects.

Business Capabilities and Potential Value to be Created

The contribution of the portfolio in the materialization of the strategy and success of the organization depends largely on the alignment of the capabilities required to incorporate for the future of the company. This is in contrast to simply observing the needs of the present.

Figure 2. Benefits generation are essential in the execution of the strategy

Source: Malagón-Barinas (2018, p. 246).



The capabilities identified to meet the needs of materialization of the strategy and thereby achieve the purposes of the future situation of the company should be characterized by: creating value (Amit & Schoemaker, 1993; Grant, 2010; Prahalad & Hamel, 1990); capturing value and; sustaining the delivery of value (Grant, 2010; Nelson & Winter, 1982).

Technological Capabilities and Value Creation

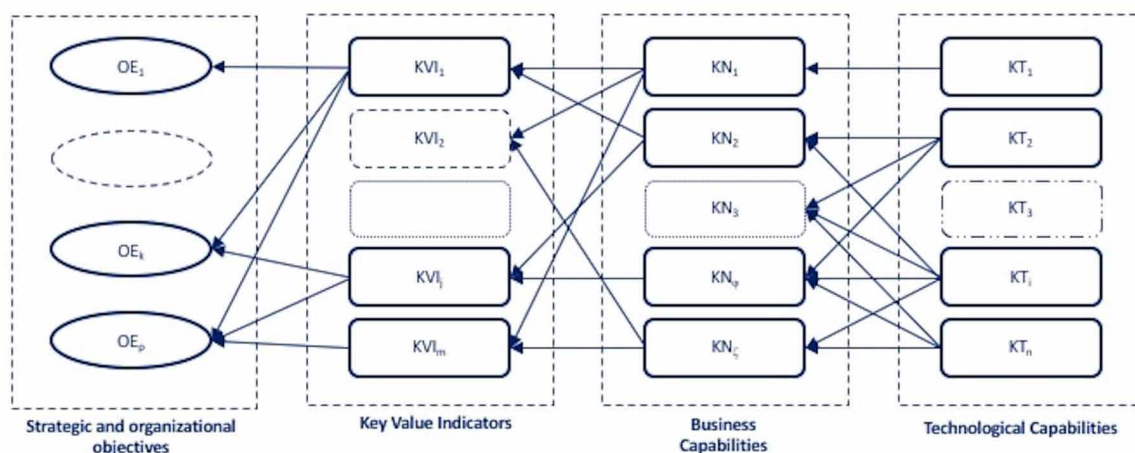
Technological capabilities should leverage the incorporation and development of the essential business capabilities required for the materialization of the strategy in the organization. IT, as a lever to create value in business capabilities, requires the company's ability to take advantage of technology as a strategic tool to differentiate itself from the competition, and to develop unique and valuable goods and services. That is to say, what is relevant is not the set of technological resources involved, but how the company uses those resources to create value. Thus, the selection of IT projects exclusively from the perspective associated with the intrinsic power of technologies loses importance.

Figure 3 indicates that at strategic level, the development of essential business capabilities is the keypoint through which value is created, and in that line, organizational success. This illustration should be analyzed in two ways as well:

1. From the strategic objectives and towards the required technological capabilities. In this analysis perspective, it is possible to identify which are the essential business capabilities required to achieve the strategic objectives and goals that will allow success.
2. From the technological capabilities to be implemented to the strategic orientation. In this direction, the performance indicators to be defined, measured, and evaluated are identified in order to ensure that essential business capabilities really contribute to the creation of value. In the same vein, it is possible to identify the level at which these capacities should be developed and what their possible path of evolution should be. The above, according to the strategic definitions and potential scenarios of changes in the environment.

Figure 3. Technological capabilities in the development of business capabilities

Source: Malagón-Barinas (2018, p. 251)



In line with what is shown in figure 3, it is identified that some business capacities require the incorporation of more than one technological capacity (KN_2 , KN_3 y KN_ϕ , KN_ζ). It should be noted that some technological capabilities generate impacts on more than one business capacity, e.g. KT_2 on KN_2 , KN_3 and KN_ϕ ; KT_i on KN_2 , KN_3 and KN_ζ ; and, KT_n on KN_3 , KN_ϕ and KN_ζ . These last two approaches allow us to understand that for the identification of capacities, in light of the potential impacts that will create value, it is necessary to evaluate them:

- Interdependencies between technological capacities.
- Interdependencies between business capabilities.
- Interdependencies between technological capacities and business capabilities.

Stakeholder Management and Value Capture

Economic theory states that consumers seek, with the resources they invest, to maximize the perception of value, through the satisfaction of their needs and expectations with the products they purchase (Parkin & Esquivel, 2010). In other words, stakeholders infer or estimate the marginal value or loss that is present in the increment differential in characteristics, functionalities, and utilities of a good and service, in relation to the differential increase in resources that must be delivered to obtain them. Based on this and according to their judgement, they make the decision to acquire them, seeking to maximize the value of the resources they possess.

Value Perceived by Stakeholders

Stakeholders' perception of the value of a functionality, utility, or technological capability incorporated by a project is based on their individual beliefs and perspectives about goods or services, their needs, experiences, desires, and expectations (Bowman & Ambrosini, 2000; Zeithaml, 1988). That is to say, as illustrated in the figure 4, interest groups perform the total valuation of a product on the perception of the use value of what they receive (V_1 o V_2), in return for the exchange value of what they deliver (R_α o R_β).

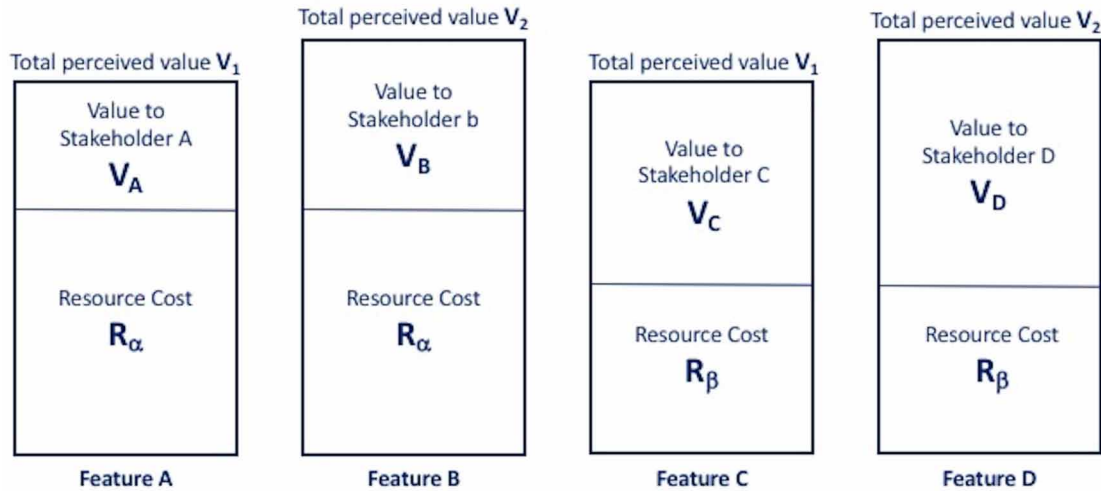
When applying figure 4 to the program and project scenario, it allows us to observe that if a stakeholder is exposed or must evaluate between different functionalities, results or alternatives (A, B, C, D), the real value it will obtain (V_A , V_B , V_C , V_D) will depend on the cost of the resources it must deliver to use them (R_α o R_β) and the total perception of value it can achieve with their use (V_1 o V_2). Consequently, the interest group, when evaluating among the functionalities of the example in figure 4, will find that it will be able to maximize value with the functionality of scenario D, taking into account that the cost of the resources that R_β must deliver is lower, and the total perceived value V_2 is higher, which exposes it to capture a greater value V_D .

Valuation of Value Potential in IT Projects

As taught in the figure 5, the benefits of an IT project are evaluated through positive changes in business capabilities. These contributions are measured with the KVIs that best represent these impacts. Thus, in the same KVI, the benefits must be observed, identified, and measured from the business capabilities that affect it.

For example, as explained in figure 5, the results delivered by the R_α resources allocated in incorporating capacity when used by clients and users generate the $B(KN_{\alpha,1})$ and $B(KN_{\alpha,j})$ benefits measured with

Figure 4. Total value perceived by stakeholders
Source: Adapted from Bowman & Ambrosini (2000, p. 3)



the KVI₁ and KVI_j indicators. At the same time, with the R_β resources the capacity β will be incorporated to generate the B(KN_{β,j}) and B(KN_{β,m}) benefits, which will be valued with the KVI_j and KVI_m.

P3S-VB Model Processes for Value Creation and Capture

The value that a stakeholder is willing to recognize for a good or service is related to its importance, quality, and usefulness (Iyer, 2009). Thus, in value creation it is considered that the interested party exchanges a resource in order to gain access to the benefit that a good or service provides. As long as that benefit meets your expectations and needs. Value will be created to the extent that the benefits are greater, at the cost of resources. The value calculation considers the dependence on allocated resources and associated benefits over time. Equation 2 shows that the value of project *x* corresponds to the Net Present Value VPN of the difference between benefit flows and resource flows.

Equation 2. Calculation of project value

$$Val_x^{Py} = VPN \left(\sum_{j=1}^m B_{x,j}^{Py} - \sum_{i=1}^n RI_{x,i}^{Py} - \sum_{j=1}^m RO_{x,j}^{Py} \right)$$

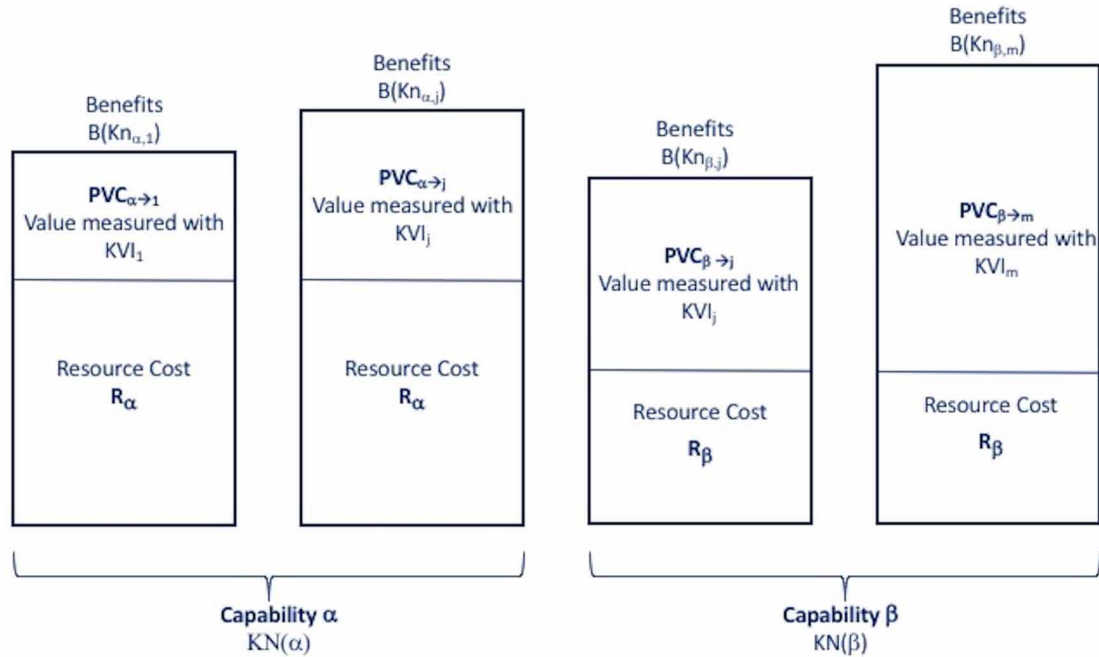
where:

$\sum_{j=1}^m B_j^{Py_x}$: is the sum of all the benefits ($j=1 \dots m$) associated to project *x*, Py_x .
 $\sum_{i=1}^n RI_i^{Py_x}$: is the sum of all investment resources RI ($i=1 \dots n$) del Py_x .

Model P3S-VB

Figure 5. Valuation of benefits through KVI

Source: Adapted from Bowman & Ambrosini (2000, p. 3)



$\sum_{j=1}^m RO_j^{Py_x}$: is the sum of all the operational resources RO ($j=1 \dots m$) del Py_x .

Source: Malagón-Barinas (2018, p. 258)

Figure 6 shows the processes associated to projects and programs portfolio selection value-based, model P3S-VB. In each of these processes, the elements, and interrelationships between them are defined. Dependencies and interdependencies between processes and between elements are also taught.

Organizational Alignment

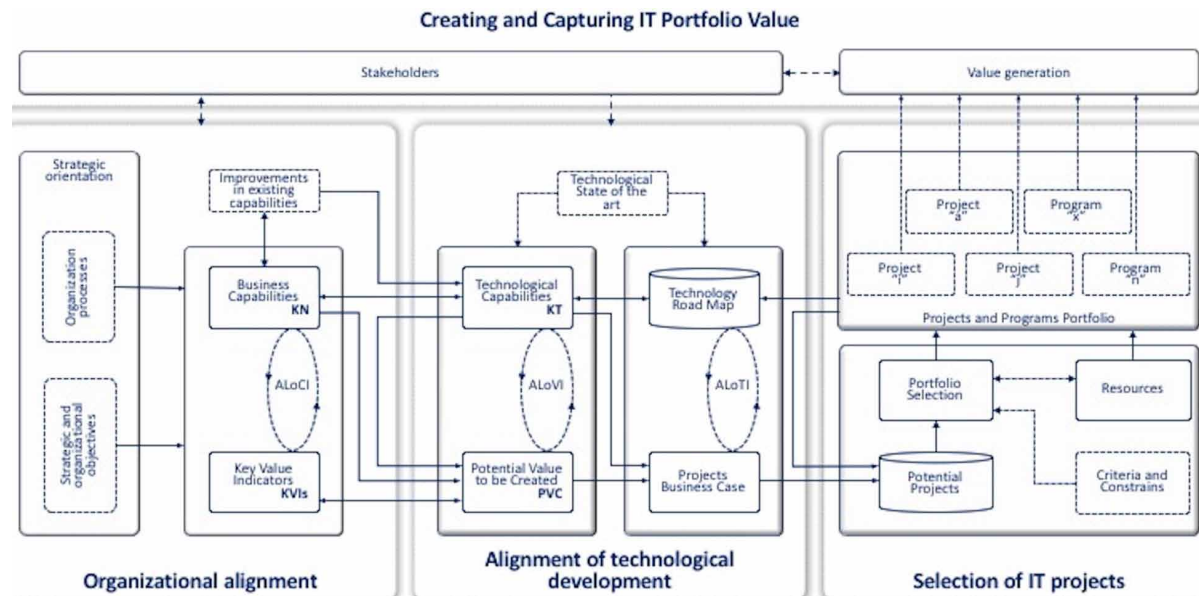
The first process in projects portfolio selection PPS, according to the P3S-VB model, is organizational alignment. This, as taught in the figure 6, aims to identify essential business capabilities, improvements in existing capabilities, aligned to strategic and organizational objectives, as well as processes. Also, in this process, the key value indicators, KVI, and the appropriate level at which these capabilities should be incorporated, ALoCI, are determined.

The figure 7 shows that the incorporation of organizational capacities compromises the closing of gaps between the current situation (Val_{Hoy}) and the desired future ($Val_{Objetivo}$) (Teece, 2009). In this gap closing the same KN capacity can be incorporated through different scenarios, and in each case deliver different levels of capacity development over time.

In the example, these scenarios (α , β or γ) in the development of the same KN, corresponds to $KN_{\alpha} : \{c_1, c_2, c_3, c_i, c_n\}$, $KN_{\beta} : \{c'_1, c'_i, c'_n\}$, and $KN_{\gamma} : \{c''_1, c''_n\}$. Each scenario offers a different set of benefits (B_{α} ,

Figure 6. Processes and elements of the P3S-VB model

Source: Malagón-Barinas (2018, p. 260)



B_β, B_γ). Like, each of them requires the allocation of a set of resources related to the scope to develop (R_x, R_y, R_z).

As described above, it can be concluded that the value generated in each scenario is mutually exclusive, so $Val(KN_\alpha) \neq Val(KN_\beta) \neq Val(KN_\gamma)$. Similarly, the required resources ($R_x \neq R_y \neq R_z$).

From another perspective, the figure 7 allows us to identify that the evaluation of value creation scenarios (α, β, γ), which contribute to the objectives of the future situation, requires the existence of measurement and traceability mechanisms in the process to achieve them. These mechanisms, financial and non-financial in nature, are Key Value Indicators or KVI's.

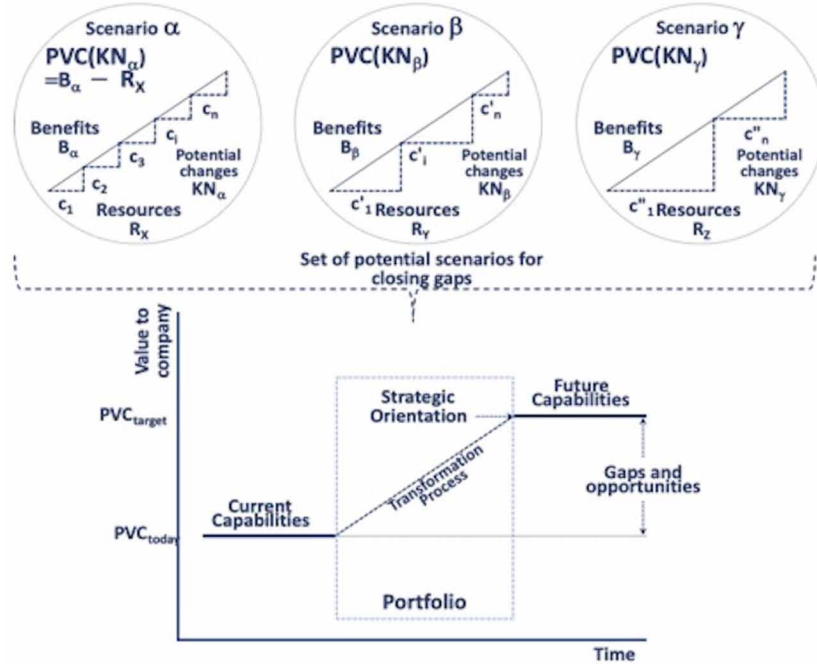
Alignment of Technological Development

The second process of the P3S-VB model and as shown in the figure 6, is the alignment of technological development. The main purpose of which is to identify the required KT technological capabilities and their appropriate level of incorporation, ALoVI and ALoTI. In doing so, contribute to the development of the KN business capabilities identified in the organizational alignment process. As in the creation of value for stakeholders and for the company.

In this process, the resources required, and the benefits associated with each of the KT are determined, the value potential to create PVC is calculated, and the risks associated with its implementation are identified. According to the above, the scope of the project is the sum of all the technological capabilities, the changes in the business processes impacted and the skills in the people that must be incorporated and developed by the project, so that clients and users find value when using them. These must achieve the purposes entrusted from the portfolio and required by the essential business capabilities.

Figure 8 shows triple restriction as follows:

Figure 7. Selection of scenarios in the closing of gaps and incorporation of capacities
Source: Adapted from Serra & Kunc (2015).



1. The scope as technology, technology level (ALoTI), requirements and total set of capabilities KT_1 , KT_2 , KT_3 , KT_i y KT_n .
2. Implementation time is related to the project timeline and the opportunity in which those capabilities are required to generate impact and create value.
3. The cost of the project is associated with the resources that the organization allocates to impact and materialize the potential for value creation associated with the scope and purpose of the project. In other words, the sum of all de CAPEX (RIKT) and OPEX (ROKT) resources required for each of the technical capacities (KT) to be developed.

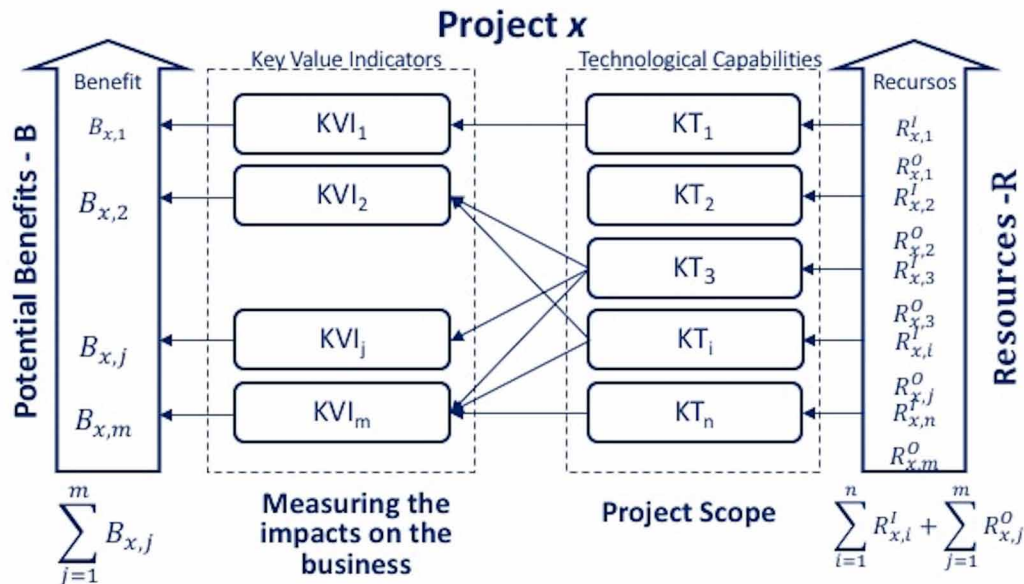
In the left part of the figure 8, the benefits from the projects are represented as the sum of all the feasible benefits to be generated ($B_{x,1}^{KT}$, $B_{x,2}^{KT}$, $B_{x,j}^{KT}$, and $B_{x,m}^{KT}$) and measure (KVI_1 , KVI_2 , KVI_j , KVI_m). At the same time, in the right part of the same illustration it is indicated which of the technical capacities (KT_1 , KT_3 , KT_i , KT_n) to incorporate, provide impacts capable of creating value from the set of resources required.

At this point it is relevant to identify in the planning of projects, those technical capabilities such as KT_2 that, when contrasted against objectives, purposes, or business cases, do not contribute to the creation of value. If these KT_2 are removed from the scope, they do not affect neither the objectives nor the purpose of the project, and on the contrary they can contribute to the increase in value, because unnecessary investments are avoided, $RI_{x,2}^{KT}$ and $RI_{x,2}^{KT}$.

There is also another challenge in the alignment of technological development, which involves stakeholder analysis, and their ability to recognize and extract the value potential identified in projects. At this

Figure 8. Value generation from technological roadmap alignment

Source: Malagón-Barinas (2018, p. 268)



point, it must be determined whether all the impacts and potential benefits related to the business case represent value for the focus groups of the project, and whether it is technically feasible to incorporate and use these capabilities in the company.

Selection of IT Projects

The purpose of the third P3S-VB process is to define the portfolio of projects, as well as the resources to be assigned to each of them. Portfolio selection should consider criteria, constraints, and restrictions (Archer & Ghasemzadeh, 1999; Cooper, Edgett & Kleinschmidt, 2002; Killen, Hunt & Kleinschmidt, 2008; Meskendahl, 2010), assess associated risk (McFarlan, 1981, 1984), and strike a balance between:

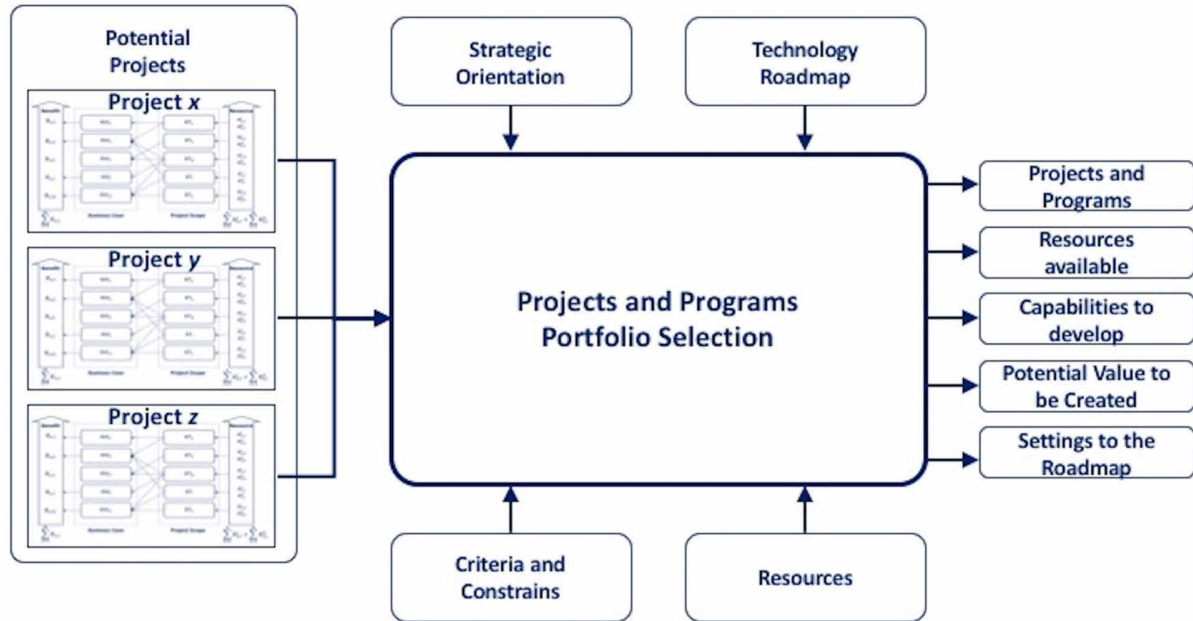
1. Optimal use of resources.
2. Feasibility of achieving strategic and organizational objectives.
3. The feasibility or viability of the technology in the organization.
4. Stakeholder perspective management.

The figure 9 shows the relationship between the bank of potential projects, the strategic orientation, the technology roadmap, the resources to be allocated and the criteria and restrictions associated with the PPS.

According to the P3S-VB model each of the initiatives that make up the bank of potential projects is represented through its business case. Likewise, in the P3S-VB model the projects that apply to the PPS, are those with potential for value creation, aligned to the purposes of the organization and in line with the technological development plan, shown on the road map.

Figure 9. Generation of value in the selection of IT projects

Source: Malagón-Barinas (2018, p. 274)



Bearing in mind that the resources required by the bank of potential projects are normally greater than those available in the company, the PPS must maximize the potential value to be created from the entire portfolio and optimize the allocation of such resources. Through the analysis of the pre-selected projects and from the parameters obtained in the individual evaluation of each of them, the PPS must assess the interactions and interdependencies between projects, value objectives and resources required.

Creating and Capturing IT Portfolio Value

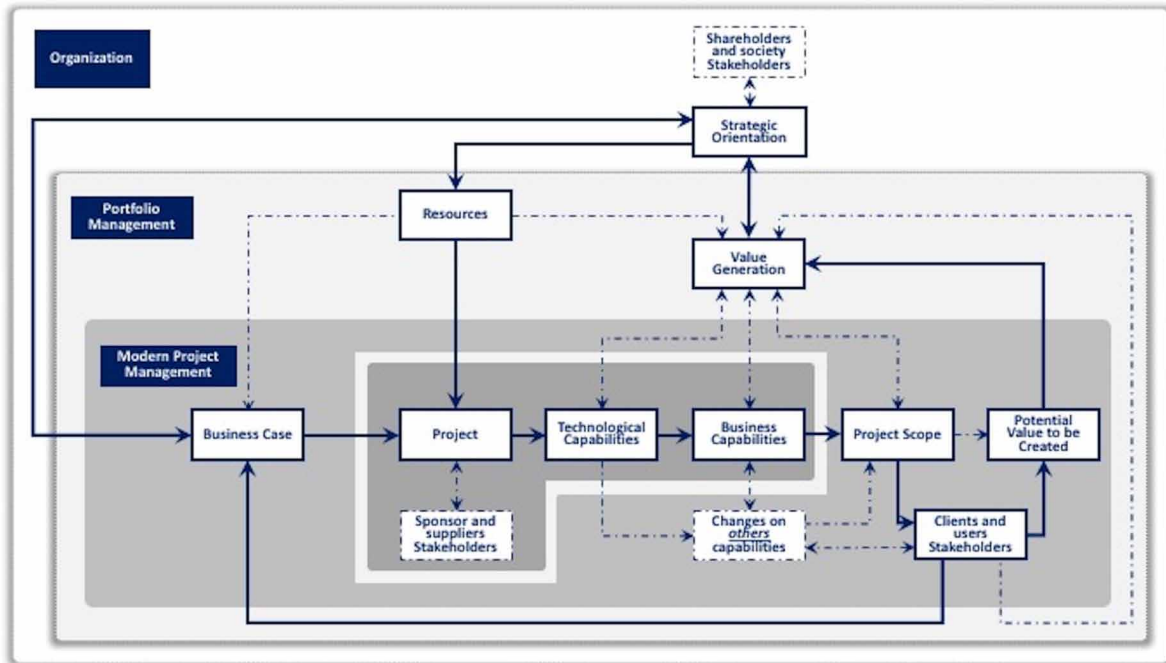
The ultimate process of P3S-VB is intended to ensure the creation and capture of value. This requires that during the execution of the portfolio, the behavior, expectations, and valuation criteria of the interest groups are managed, in particular that of clients and users (Argandoña, 2011; Voss & Kock, 2013). Likewise, it is necessary to monitor profit expectations, not only for individual projects, but also for the interdependence between all the components within the portfolio (Serrador & Turner, 2015; Turner & Zolin, 2012).

The Figure 10 represents the vision of the direction of the projects and the portfolio in the context of the P3S-VB. It can be observed that the orientation to the generation of value is the main axis of the portfolio management. The management of stakeholders (project sponsor, suppliers, project team, customers, and users) is the foundation of value creation during project management.

The diagram in the figure 10 indicates that the mission of projects is to contribute to the development of essential business capabilities. Using a set of resources that the organization provides, so that, with the guidance of a sponsor, the support of suppliers and the work of the project team, the scope and development of technological capabilities is materialized.

Figure 10. Project and portfolio management - P3S-VB

Source: Malagón-Barinas (2018, p. 279)



The modern management of projects as shown in the figure 10 has the additional purpose of materializing the scope in time and cost, the delivery of results capable of contributing with positive impacts, which when used by clients and users generate the potential value or planned benefits of the project.

At the same time, the management of the portfolio in interaction with the organizational purposes, framed in its strategic orientation, evaluates, and manages the generation of value of the projects. As shown in the figure 10, the management of the portfolio generates value from the evaluation of the business case of the potential project, the optimal allocation of resources, the identification and management of interest groups that contribute to or affect the creation and capture of value, as well as the monitoring of the fulfillment of the promise of value of the projects, during its execution stage, as well as in the use stage of the incorporated products.

Model P3S-VB Tools

The P3S-VB relies, among many others, on five tools to contribute to increased value in the selection of the IT project portfolio. These tools help determine and manage benefits, analyze stakeholder perceptions of benefits, identify organizational capabilities, maximize value potential to create in portfolio selection, evaluate ALoTI and ALoVI, and in the selection of IT projects.

Analysis of Stakeholders' Benefits Perception

Figure 11 shows the tool for identifying different scenarios in the analysis of the perception of benefits or harms from the point of view of stakeholders. The different scenarios in the perception of benefits and harms from the point of view of each of the project's stakeholders (PS) are described below:

1. PS-0 is the PS responsible for the decision making and allocation of resources required to incorporate the change associated with PVC_1 . That is to say, it is the owner of the resources to materialize PVC_1 , who during the planning and execution of the project has decision on its scope, continuity, changes, or cancellation.
2. It is assumed that for PS-0, as the resource allocation manager, the result of PVC_1 must represent a benefit. However, from the analysis carried out, it can be identified that the benefit captured by PS-0 of PVC_1 may be the result of the benefit perceived by other interested parties, which directly or indirectly return value to it.
3. PS-1 perceives PVC_1 as positive. Therefore, for PS-1 this will be a benefit, regardless of the perception of the other interested parties.
4. PS-2 perceives PVC_1 as something negative for her. So, regardless of what PS-1 perceives, this change is detrimental to him. In this sense, the impact of the perception of PS-2 will have to be evaluated from the beginning of the project.

The magnitude of the perceived damage, the level of influence of this stakeholder on the project and on the overall results of the portfolio should be assessed. In addition, the damage to PS-2 must be compared with the level of investment required for PVC_1 and the magnitude of the benefit to be created for the other interested parties.

5. Stakeholders 3, 4 and 5 (PS-3, PS-4 and PS-5) do not observe a direct impact of PVC_1 , however, whether they perceive benefits or detriments of PVC_2 . According to the scenarios presented in figure 11, PVC_1 (value associated with a planned impact incorporated by the project), will generate a collateral PVC_2 impact.

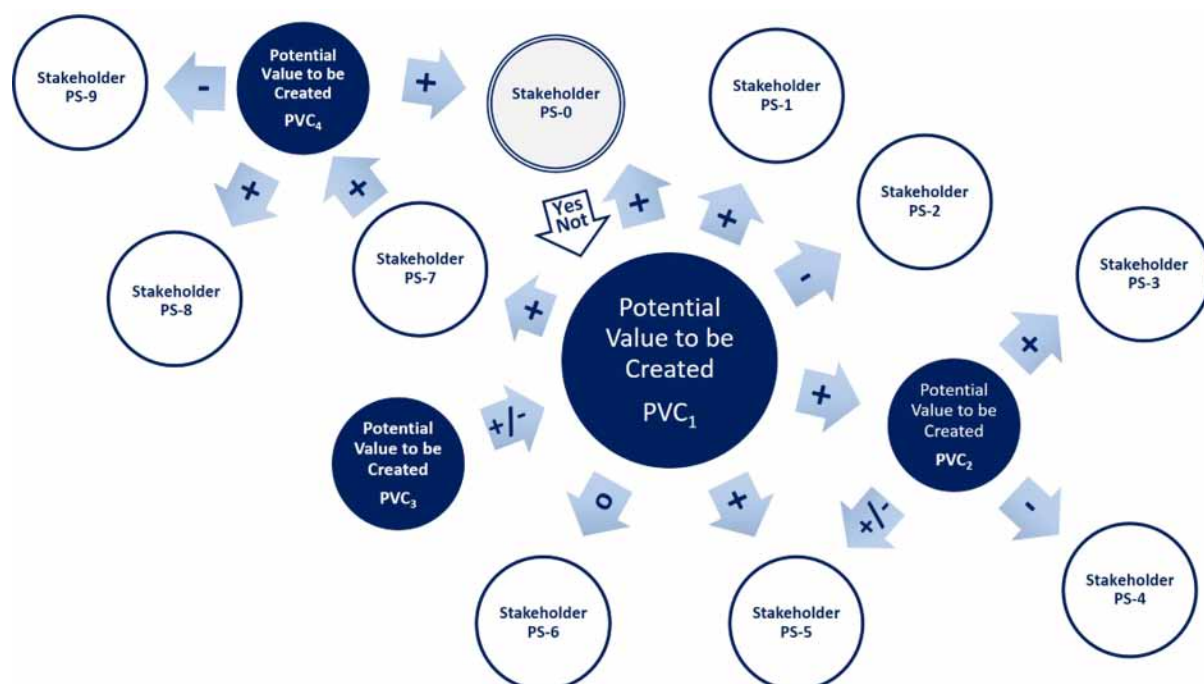
In this analysis, PVC_2 does not necessarily correspond to a planned change incorporated by the project. It therefore corresponds as an emerging benefit derived from PVC_1 .

6. Thus, the positive impacts perceived by PS-3 and PS-5(+) are indirect or emerging benefits of PVC_1 . Therefore, in the analysis of the accumulated benefits of PVC_1 , what was created for PS-3 and PS-5 as a consequence of PVC_2 should be incorporated.
7. For its part, the damage perceived by PS-4 and PS-5(-) should be assessed in an exercise similar to that proposed for PS-2, bearing in mind that this impact is indirect on the incorporation of PVC_1 . In this analysis the relevance of PS-4 to the planned changes to PVC_1 should be assessed and the magnitude of the risk of its perception of the results and benefits of the project should be considered.
8. PS-5 perceives benefits directly from PVC_1 and indirectly can also benefit from the emergence of PVC_2 . Therefore, the magnitude of these two impacts on PS-5 should be assessed, whether these benefits are mutually exclusive, or whether there is any overlap that should be considered when performing the comprehensive assessment of the positive impact to be created by PVC_1 .

However, this analysis invites to contemplate what happens if PS-5 perceives direct benefit from PVC_1 and is indirectly harmed by PVC_2 (inherited from PVC_1). In this scenario, a comprehensive analysis of this group of stakeholders is necessary. Depending on the magnitude of perceived benefits and harms, relevance of this stakeholder on the results to be incorporated by the portfolio and the associated risks, decide on adjustments on the scope to be developed in PVC_1 , mitigate the harms of PVC_2 on PS-5 or ignore them.

9. PS-6 does not receive any benefits or detriment as a consequence of PVC_1 . However, if PS-6 is a group of stakeholders of relevance to the company and to the results of the changes to be incorporated, the reasons why there is no positive perception of this stakeholder group should be identified. Adjustments to PVC_1 should also be made or the management required to change the perception of PS-6 on PVC_1 results should be evaluated. This type of analysis should be carried out, not only when there are stakeholders who do not perceive the built-in impacts, but when they perceive them as negative.
10. PS-7 is an interesting case in this scenario analysis. With the benefits captured from PVC_1 , PS-7 autonomously undertakes the incorporation of PVC_4 , thus generating positive impacts for PS-8. It is important to note that this scenario reflects, in part, Porter & Kramer's (2011) proposal on the creation of shared value. Shared value arises when PVC_4 changes, which autonomously incorporate PS-7, create benefit and value for PS-0.
11. The analysis of what is relevant to the perception of PS-9, in this case, is not subject to PVC_1 , but to what PS-7 decides to incorporate in PVC_4 .

Figure 11. Analysis of stakeholders' perception of benefits in a project
Source: Malagón-Barinas (2018, p. 282)



Model P3S-VB

Although it is not the purpose of PVC_1 to impact on PS-9, it should be assessed that PVC_4 results do not incorporate prejudice to relevant project stakeholders and in a broader organizational context.

12. Finally, it is important to analyze the impacts on PVC_1 from other PVC_3 changes planned from the portfolio, either from the project itself, at the level of a program or from some other type of initiative. This scenario raises the need for:
 - Evaluate the aggregation of benefits of each change to be incorporated, independently and in conjunction with other changes.
 - Analyze the investment needs required by each change and integrally with the other changes.
 - Value the individual and cumulative contribution of these changes to the organization's objectives.
13. Therefore, at the portfolio level, it is pertinent to consider the interdependencies between the PVC_1 's and the PVC_3 's, the requirement of the scarce resources to be allocated and the accumulated contribution of benefits to be generated, seeking to optimize these value creation relationships at the organization's portfolio level.

IT Benefits Management Cycle

In the critical review of the scientific, industrial and benefit management literature, it was identified that the IT benefit management cycle model developed by Cranfield University (Ward, Taylor & Bond, 1996), is the dominant and the one that consistently groups together all the processes required in benefit management.

The figure 12 shows the adaptation of this cycle to the purposes and scope of the P3S-VB model. So that, as a tool, it contributes to the identification, planning, materialization, evaluation, and sustainability of benefits, and thereby contributes to the generation of value for the organization.

Identification and Quantification of Value Potential

In this process the value potential to create PVC from the IT initiative is determined. According to their nature, potential benefits are aligned with strategic and organizational processes, capabilities, and objectives (PMI, 2017; Ward & Daniel, 2012). It also identifies the benefits that are most relevant and impact for decision-makers.

Structuring and Planning of the Value Potential to be Created

Its purpose is the elaboration of the complete plan to achieve the materialization of the value potential to be created, as well as the structuring of the business case to evaluate the viability of the investment (Ward & Daniel, 2012). It is required to define a business area manager for each benefit within the plan. Benefits to which it is not possible to assign responsibility or structure a plan should be discarded (Ward et al., 1996).

Execution, Delivery, and Materialization of Benefits

During this process, all the actions necessary to generate all the results specified in the benefit plan are executed (Ashurst & Doherty, 2003; PMI, 2017). According to the above and in line with Ashurst (2011),

Serra (2016) and Zwikael & Smyrk (2011) it should be stated that the scope of this process goes from the moment in which the project is started from the portfolio and until the benefits are used in a stable way by the interest groups, in harmony with what is exposed in the ITO model.

Review and Evaluation of Results

As changes are incorporated, delivering results, and creating value, follow-up, monitoring, control, and review must be made to evaluate compliance with the plan (Letavec, 2014; Serra, 2016). Likewise, once the new IT in the business has delivered results and is used by stakeholders, an assessment must be made to really determine what was achieved by the project (Ward & Daniel, 2012).

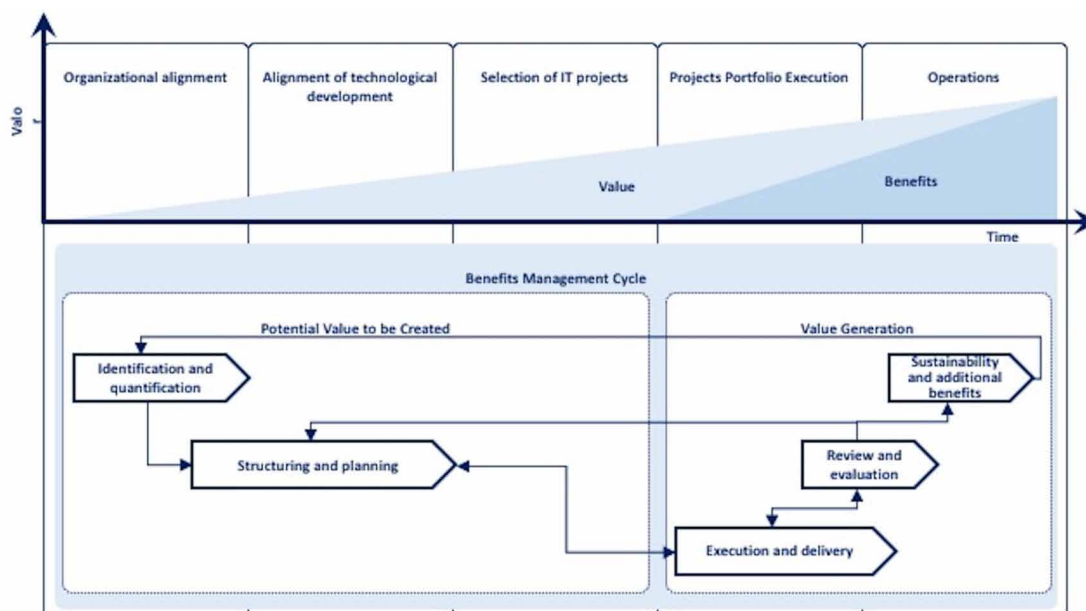
Sustainability and Additional Benefits

Sustainability and identification of emerging benefits is the end-of-life process of benefits. The purpose of sustainability of benefits is to ensure that the company and in particular the business areas impacted by the incorporated IT, are able to maintain the generation of benefits through the use of new technological capabilities and delivered results, when the program or project that incorporated them closes (Letavec, 2014).

In this process, the emerging benefits arising from the technological capabilities already incorporated should be capitalized on (Serra, 2016). Which were not foreseen in the identification and planning stages. Therefore, this stage seeks to maximize and extend the delivery of value from the changes and results already incorporated (Ward & Daniel, 2012).

Figure 12. Benefits management cycle model P3S-VB

Source: Malagón-Barinas (2018, p. 285)



Identification of the Level of Value Creation LoV, ALoTI and ALoVI

This numeral describes the mechanisms for calculating the level of value creation. *LoV* for a technological capacity (KT) and for a project (Py).

Value Creation Level - LoV

The Level of Value *LoV*² value creation indicator was developed based on the researcher's experience and was based on the value for money ratio VMR proposed in Management of Value (OGC, 2010). The purpose of the *VMR* is to optimize the use of resources as a pillar of value engineering (SAVE, 2007). The P3S-VB model adapted and validated the VMR and from there the following formulas were derived. For the list of technical capacities KT in the projects, equation 3 was defined. And, for the contribution of the projects in the portfolio, equation 4.

Equation 3(a) indicates that the LoV_i^{KT} of a KT_i within a project x, Py_x is the relationship between the benefit contribution of that KT_i in the project, $(\Delta B_i^{KT} = B_i^{KT} / B_x^{Py})$, with respect to the percentage of project resources required for the incorporation of the project, $(\Delta R_i^{KT} = R_i^{KT} / R_x^{Py})$.

In other words, and using for better understanding equation 3(b), the LoV_i^{KT} is the incremental contribution of the value potential of the KT_i in the value offer of the whole project Py_x .

$$(LoV_i^{KT} = \Delta B_i^{KT} / \Delta R_i^{KT} = \Delta PVC_i^{KT} = PVC_i^{KT} / PVC_x^{Py}).$$

Equation 3(c) shows that the $\overline{LoV_i^{KT}}$ calculates the most likely level of value creation.

Equation 3. *Level of value creation of a KT in a project.*

$$\overline{LoV_i^{KT}} = \frac{B_i^{KT} * rTB_i^{KT}}{\sum_{j=1}^m (B_j^{KT} * rTB_j^{KT})} * \frac{\sum_{k=1}^n R_k^{KT}}{R_i^{KT}} = \left(\frac{B_i^{KT}}{B_x^{Py}} / \frac{R_i^{KT}}{R_x^{Py}} \right) * \frac{rTB_i^{KT}}{rTB_x^{Py}} \quad (a)$$

$$\overline{LoV_i^{KT}} = \frac{PVC_i^{KT}}{PVC_x^{Py}} * \frac{rTB_i^{KT}}{rTB_x^{Py}} \quad (b)$$

$$\overline{LoV_i^{KT}} = LoV_i^{KT} * \frac{rTB_i^{KT}}{rTB_x^{Py}} \quad (c)$$

Source: Malagón-Barinas (2018, p. 292)

The factors of equation 3 are described in the table 1.

Equation 8-5(a) indicates that the value capture level. $\overline{LoV_x^{Py}}$ of a project x, Py_x inside an IT portfolio, PP_{TI} is the relationship between the benefit contribution of that Py_x in the portfolio,

Table 1. Factors for the calculation of the LoV of a KT in a project

Factor	Meaning or calculation
LoV_i^{KT}	Relationship of planned benefits to resources in a KT. It represents the relationship between the PVC_i^{KT} of the KT_i in relation to the PVC_x^{Py} del Py_x $LoV_i^{KT} = \frac{PVC_i^{KT}}{PVC_x^{Py}}$. • If, the $LoV_i^{KT} > 1$, indicates that the KT_i contributes to create value in project x. • If, the $LoV_i^{KT} \leq 1$, it must be assessed whether the KT_i contributes to the PVC^{KT} of another KT in which case they should be assessed jointly. Otherwise that KT_i is not required in the project.
$\overline{LoV_i^{KT}}$	Ratio of likely benefits to required resources. Indicates that both of the planned value to create from a KT will probably be generated. It is an indicator of the feasibility of using the products to be incorporated.
B_i^{KT}	Improvements perceived as positive by one or more stakeholders, as a consequence of their use of the incorporated results, by means of the KT_i . These are calculated, through the sum of the Net Present Value.
B_x^{Py}	Sum of all benefits identified and measurable in project $\sum_{j=1}^m B_j^{KT}$
$\sum_{j=1}^m (B_j^{KT} * rTB_j^{KT})$	It is the sum of all the probable benefits that can be obtained from the totality of the KT from KT_1 to KT_m identified to be incorporated in a project Py_x in particular. Expected value of benefits $\mu(B_x^{Py}) = B_x^{Py} * rTB_x^{Py} = \sum_{j=1}^m (B_j^{KT} * rTB_j^{KT})$.
rTB_i^{KT}	Probability $p(B_i^{KT_{TB}})$.to generate benefits from the impacts of the KT_i .
rTB_x^{Py}	Probability $p(B_x^{Py_{TB}})$ to generate the planned benefits in the Py_x $rTB_x^{Py} = \frac{\sum_{j=1}^m (B_j^{KT} * rTB_j^{KT})}{B_x^{Py}}$
R_i^{KT}	Resources consist of the tangible and intangible assets that are required to incorporate the KT_i . Normally, resources are expressed between the investment capital assets CAPEX ($R_{KT_i}^I$) and the recurring ones for the sustainability of the KT associated to OPEX ($R_{KT_i}^O$), this means $R_i^{KT} = R_{KT_i}^I + R_{KT_i}^O$. These are calculated, through the Net Present Value. It must be included here, the $R_{KT_i}^O$ associated with giving sustainability to the KT during the period they deliver benefits.
$R_x^{Py} = \sum_{k=1}^m R_k^{KT}$	Is the sum of all required resources $R_x^{Py} = \sum_{k=1}^m R_k^{KT} = \sum_{k=1}^m R_{KT_k}^I + \sum_{k=1}^m R_{KT_k}^O$ to incorporate all the KT of project x , from KT_1 to KT_m . These are the total resources of the project Py_x .
PVC_i^{KT}	Potential value to be created from KT_i . It equals $PVC_i^{KT} = \frac{B_i^{KT}}{R_i^{KT}}$
PVC_x^{Py}	Potential value to be created from project x . It equals $PVC_x^{Py} = \frac{B_x^{Py}}{R_x^{Py}}$

Source: Malagón-Barinas (2018, p. 293-294)

$(\Delta B_x^{PY} = B_x^{PY} / B_{TI}^{PP})$, with respect to the percentage of project resources required for the incorporation of the project, $(\Delta R_x^{PY} = R_x^{PY} / R_{TI}^{PP})$, and affected by the maximization factor of the project's value in the portfolio $fDM_x^{Py} = \frac{pCV_x^{Py}}{pCV_{TI}^{PP}}$.

The fDM_x^{Py} represents the relationship between the probability of generating value with the project, pCV_x^{Py} with respect to the probability of generating value in the portfolio pCV_{TI}^{PP} . The probability pCV_x^{Py} is calculated from the portfolio maximization factors described previously. These maximization factors are associated with the potential for value creation $LoCV_x^{Py}$ and the feasibility of capturing that value $LoFV_x^{Py}$.

In turn, the probability of generating value in the portfolio is calculated as the relationship between the weighted benefits of the project to the portfolio and the probability of generating value from each project, $pCV_{TI}^{PP} = \frac{\sum_{j=1}^m (B_j^{Py} * pCV_x^{Py})}{B_{TI}^{PP}}$.

Equation 4. Value creation level of a project in the IT portfolio

$$\overline{LoV_x^{Py}} = \frac{\Delta B_x^{PY}}{\Delta R_x^{PY}} * \frac{pCV_x^{Py}}{pCV_{TI}^{PP}} \text{ (a)}$$

$$\overline{LoV_x^{Py}} = \frac{PVC_x^{Py}}{PVC_{TI}^{PP}} * fDM_x^{Py} \text{ (b)}$$

$$\overline{LoV_x^{Py}} = LoV_x^{Py} * fDM_x^{Py} \text{ (c)}$$

Source: Malagón-Barinas (2018, p. 295)

The factors of the Equation 4 are described in the Table 2.

Diamond to Maximize the Value to be Created

The maximization diamond in the portfolio selection, shown in the figure 13, indicates that you can increase the probability of generating project value (pCV_x^{Py}) , by taking stock of the following four factors. Optimal use of resources $(LoRU_x^{Py})$ and the feasibility of achieving the strategic and organizational objectives $LoOE_x^{Py}$ which contribute to the creation of value $(LoCV_x^{Py})$. In turn, the feasibility of technology in the organization $(LoFT_x^{Py})$ and stakeholder perspective management $(LoSM_x^{Py})$, which increase the feasibility of creating and materializing value $(LoFV_x^{Py})$.

Table 2. Factors for the calculation of the LoV of a project in the portfolio

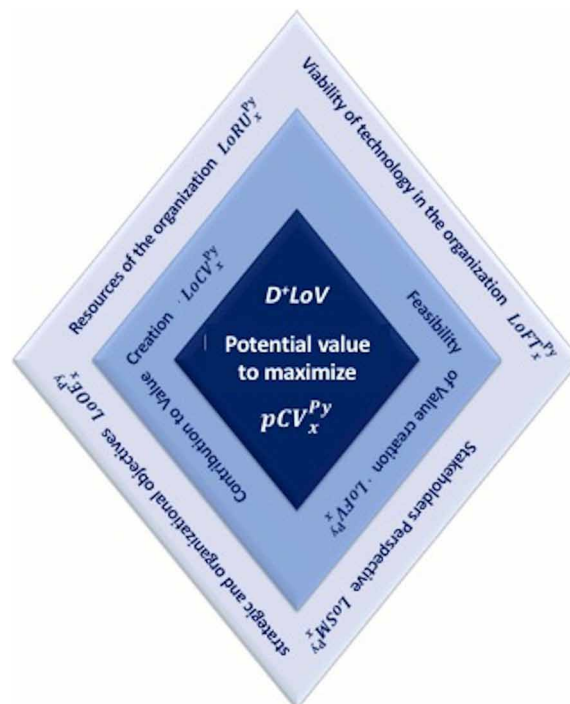
Factor	Meaning or calculation
LoV_x^{Py}	Level of value creation of the project Py_x. It is the ratio of planned benefits to resources of a project or program x. Like, it is the valuable contribution of a Py_x in relation to the PVC_{TI}^{PP} of the IT portfolio. $LoV_x^{Py} = \frac{PVC_x^{Py}}{PVC_{TI}^{PP}}$ • If $LoV_x^{Py} > 1$, shows that the Py_x creates value in the portfolio. • If $LoV_x^{Py} \leq 1$, it must be assessed whether the Py_x is required by any requirement of law, regulation or to mitigate any business risk. Like, if that Py_x contributes to the value creation of another Py_{ex}. In which case, this scope should be included in the other Py_{ex} and evaluate them together, even if they must be executed separately. Otherwise that Py_x is not needed in the portfolio.
$\overline{LoV_x^{Py}}$	Value capture level. It shows that both the PVC of Py_{ex} will probably be generated. It is an indicator of the likely level of value capture of the project x .
pCV_x^{Py}	Probability $p(B_x^{Py_{cv}})$ to generate value with the project Py_{ex} . This factor is calculated from the maximization factors of the D+LoV LoV portfolio. And it contemplates both the elements that contribute to the creation of value $LoCV_x^{Py}$ as well as the feasibility of achieving it $LoFV_x^{Py}$.
pCV_{TI}^{PP}	Probability $p(B_{TI}^{PP_{cv}})$ to generate portfolio value $pCV_{TI}^{PP} = \frac{\sum_{j=1}^m (B_j^{Py} * pCV_x^{Py})}{B_{TI}^{PP}}$
fDM_x^{Py}	Maximization factor of the project's value in the portfolio $fDM_x^{Py} = \frac{pCV_x^{Py}}{pCV_{TI}^{PP}}$
R_{TI}^{PP}	Resources required to be distributed from the portfolio for programs, projects, and other pre-selected activities, from Py_1 to Py_n $R_{TI}^{PP} = \sum_{i=1}^n R_i^{Py}$.
PVC_{TI}^{PP}	Potential value to be created from the IT project portfolio $PVC_{TI}^{PP} = \frac{B_{TI}^{PP}}{R_{TI}^{PP}}$

Source: Malagón-Barinas (2018, p. 295-296)

1. Optimal use of the organization's resources ($LoRU_x^{Py}$). The incorporation of the scope of the project requires the allocation of financial resources, as well as physical, technical, personal, and organizational resources. From this set of resources, the financial ones, normally, once defined are assigned. However, in many cases the physical, technical, organizational and people for the execution of the projects are not available or there are restrictions to access them or they do not have the required quality. Thus, when prioritizing projects, preference should be given to those whose availability of critical resources for execution is greater rRC_x^{Py} . As well as those where the value potential to be created is maximized (PVC_x^{Py}).

2. Feasibility of achieving strategic and organizational goals ($LoOE_x^{Py}$). Each initiative in the bank of potential projects must contribute with some purpose of the company, in that order of ideas, there will exist projects with greater contribution to the goals of greater relevance, with respect to others. Therefore, in the PPS, greater priority should be given to those projects with greater alignment (rAE_x^{Py}) and with a greater contribution to their materialization (rME_x^{Py}). Just as projects should be preferred that contribute to the mitigation or reduction of strategic and organizational risks (rRO_x^{Py}).
3. Feasibility of technology in the organization ($LoFT_x^{Py}$). The technological capacities and their associated functionalities imply technical challenges in their incorporation, as well as in their use. From technical feasibility, the level of complexity (rTI_x^{Py}) of technology, integrations, interconnections, and migrations associated with its incorporation, as well as compatibility with existing and future technologies. In addition to the level of complexity, or its complement the level of simplicity (rSI_x^{Py}), consideration should be given to the depth or level of definition of the scope achieved in project planning (rDP_x^{Py}). This considering that to the extent that the project planning has a high degree of definition of scope, the risk and complexity scenarios associated with implementation will be identified. And, in this line will be achieved in the execution, increase the technical feasibility of deploying the technologies of the project.

Figure 13. Diamond to maximize the value to be created in the PPS - D^*LoV
Source: Malagón-Barinas (2018, p. 304)



In turn, the feasibility of use is associated with the generation of benefits from technological capabilities (rTB_x^{Py}) , as well as the degree of maturity of the processes impacted with IT (rMP_x^{Py}) .

4. Stakeholder perspective management $(LoSM_x^{Py})$. Feasibility for capturing value is subject to customers and users identifying, using, and recognizing the positive impacts of built-in capabilities. Therefore, those projects in which the management of these stakeholders is best defined (rSH_x^{Py}) and have the mechanisms to achieve recognition of value, should be preferred.

On the other hand, the same stakeholder may have expectations of incorporated impacts from more than one capacity and from more than one project. In this case, the impacts, synergies, and interdependencies must be evaluated, identifying opportunities to optimize the allocation of resources or to increase the value to be captured by the company.

In addition, by managing the perspective of stakeholders, it is possible to identify both the mechanisms for measuring these KVI impacts and the viability associated with the creation of value from the impacts and changes associated with each of the technological capabilities incorporated (rAV_x^{Py}) . In this way, a higher priority can be assigned to the projects with the greatest viability in taking advantage of the benefits generated.

Probability of Generating Value With the Project

Maximizing the value potential identified in project planning is the main purpose of the P3S-VB model. To this end, the *Analytic Hierarchy Process* AHP (Archer & Ghasemzadeh, 1999) calculates the probability of generating value in IT projects, starting from the contribution in the creation of value and contrasting it against the feasibility of materializing such expectations.

The probability of generating value with the project pCV_x^{Py} is calculated from portfolio maximization factors. And it contemplates both the elements that contribute to the creation of value $LoCV_x^{Py}$ as well as the feasibility of achieving it $LoFV_x^{Py}$.

The valuation of the contribution to the creation of value is carried out, applying the AHP methodology, based on the different factors described in the table 3, whose estimation is made by the portfolio management in coordination with the business areas and those responsible for the strategic orientation in the company. The equivalent is done, from the variables in the table 4 to budget the feasibility associated with the materialization and creation of the planned value.

Classification Matrix of the Potential for Generating Value From Projects

In the P3S-VB model, the probability of generating value with the project, pCV_x^{Py} is used to support the prioritization and selection of IT portfolio projects. The factors making up this indicator are used to rank initiatives according to their level of contribution to value creation, $LoCV_x^{Py}$ and in accordance with the feasibility associated with the creation and materialization of the planned value in the project, $LoFV_x^{Py}$.

The figure 14 shows the classification matrix according to the factors described above. There it can be observed that, in line with the diamond purposes of maximizing the value potential to be created,

Model P3S-VB

Table 3. Contributing factors to value creation

Maximization of the contribution to the creation of value - $LoCV_x^{Py}$	Factor	Definition or meaning in the model
Feasibility of achieving strategic and organizational objectives	rAE_x^{Py}	Level of alignment with the strategic orientation of the Py_x .
	rME_x^{Py}	Probability $p(B_x^{Py_{ME}})$ associated with the contribution of the Py_x in the materialization of the company.
	rRO_x^{Py}	Contribution level of the Py_x to the reduction of organizational risks.
Optimal use of the organization's resources $LoRU_x^{Py}$	rRC_x^{Py}	Availability and quality of critical resources for the execution of the Py_x .
	PVC_x^{Py}	Value potential to be created from the Py_x .

Source: Malagón-Barinas (2018, p. 306)

projects can be prioritized according to their classification in the matrix, or according to the level of value creation, LoV_x^{Py} or depending on the value capture level, LoV_x^{Py} .

1. The projects that contribute most to the organization will be those that not only have a better balance between the optimal use of the company's resources, alignment and contribution to the materialization of the strategic orientation, but also represent less risk in its implementation, feasibility of the use of incorporated technologies and greater value capture, $LoV_x^{Py_i}$. In other words, the

Table 4. Feasibility factors to create or materialize value

Maximizing the feasibility of creating value - $LoFV_x^{Py}$	Factor	Definition or meaning in the model
Feasibility of technology in the organization $LoFT_x^{Py}$	rSI_x^{Py}	Level of simplicity in the incorporation of the technologies of the scope of the Py_x .
	rTB_x^{Py}	Probability $p(B_x^{Py_{TB}})$ of the use of technology and generation of benefits in the Py_x .
	rMP_x^{Py}	Maturity level of the processes impacted the results and products of the Py_x .
	rDP_x^{Py}	Level of planning or definition of potential Py_x .
Stakeholder perspective management $LoSM_x^{Py}$	rSH_x^{Py}	Level of definition of the management of the stakeholders of the Py_x .
	rAV_x^{Py}	Probability $p(B_x^{Py_{AV}})$ of exploitation and capture of value in the Py_x .

Source: Malagón-Barinas (2018, pp. 307-308)

projects that are classified in the quadrant one of the figure 14 will have priority in the selection of the portfolio, because they have the greatest potential to generate value.

2. The next group of projects in priority for selection in the portfolio may be those classified in quadrant two or quadrant three. The priority of one quadrant over the other is subject to risk aversion by portfolio and organizational decision-makers.

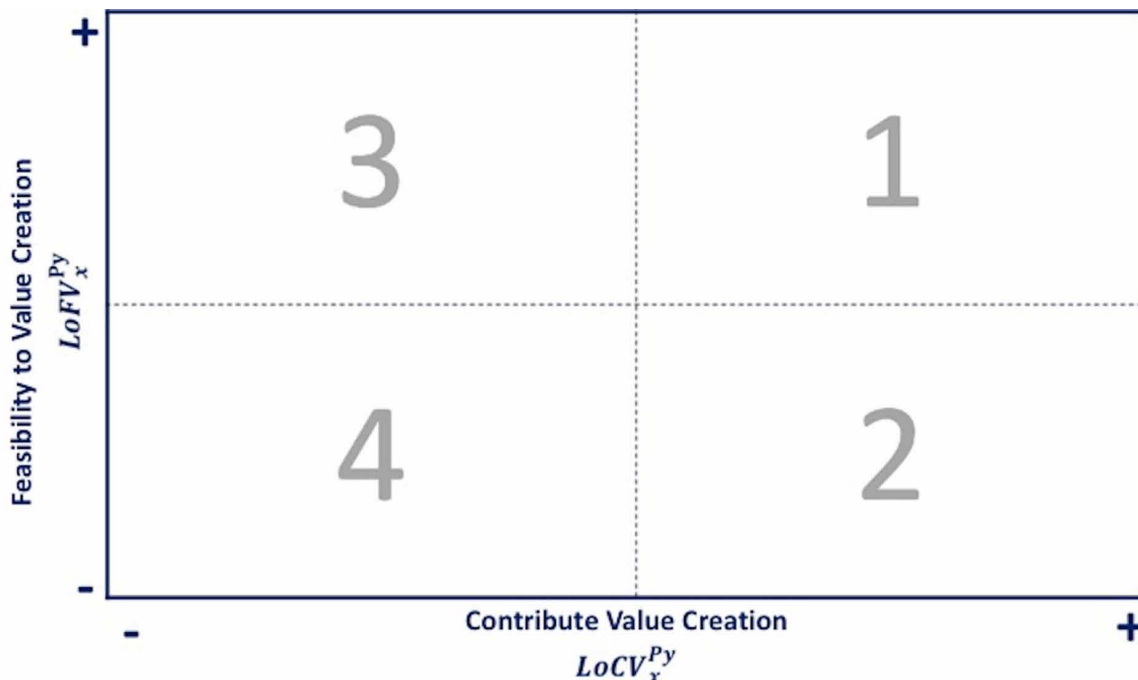
Returning to the example used to calculate the probability of generating value with the project, pCV_x^{Py} . It can be said that, in the applied case, the decision-makers were more inclined towards the contribution of the projects to the creation of value, versus the risk or feasibility associated with materializing it.

It should be noted that the prioritization indicator pCV_x^{Py} allows to discriminate those projects with greater probability of generating value between those belonging to quadrant 2 with respect to 3, or vice versa. However, the prioritization of projects in one quadrant over the other, as opposed to classifying them directly with the other quadrant $LoV_x^{Py} \cdot \overline{LoV_x^{Py}}$ is optional for decision-makers in portfolio selection.

3. It should be borne in mind that these indicators are related through the value maximization factor, fDM_x^{Py} . of the project in the portfolio, $\left(\overline{LoV_x^{Py}} = LoV_x^{Py} * fDM_x^{Py}\right)$. Consequently, if the deci-

Figure 14. Classification matrix of portfolio projects

Source: Malagón-Barinas (2018, p. 314)



sion is to select the projects from the classification matrix of the D+LoV value generation potential of the projects, the following indicator should preferably be used in the decision $\overline{LoV}_x^{Py}$.

4. The projects classified in quadrant four, although their potential for value creation may be favorable ($PVC_x^{Py} > 1$), not necessarily the probability of contribution to value creation $LoCV_x^{Py}$ is the best. Likewise, a project classified in this quadrant represents an elevated risk for the portfolio, considering the lower feasibility of materializing and creating value $LoFV_x^{Py}$.

Projects classified in this segment should be evaluated one by one, not only because of their potential value to be created, but also because of the risk inherent in their implementation.

Finally, it should be noted that the four maximization factors, together with the value generation potential classification matrix, allow additional maximization analyses to be performed on projects. For example, you can analyze the components that positively or negatively influence the feasibility of creating or materializing the planned value. That is, between the viability of technology in the organization and the perspective of stakeholders. With this, for example, it is possible to identify the focus that should be addressed in the direction of projects to increase value, decrease technological complexity, or how to achieve greater use and generation of benefits, etc.

Objective Function and Prioritization Algorithm of the IT Portfolio

This tool to support the P3S-VB model has as its scope the selection of the IT portfolio. This selection mechanism is one of many that can be used from the prioritization of projects. The order of eligibility of the projects is carried out from the value capture level indicator $\overline{LoV}_x^{Py}$ which depends on the probability of generating value in the project pCV_x^{Py} with respect to that of the whole portfolio pCV_{TI}^{PP} . It means,

$$\overline{LoV}_x^{Py} = LoV_x^{Py} * \frac{pCV_x^{Py}}{pCV_{TI}^{PP}}.$$

The probability pCV_x^{Py} is obtained as a result of D+LoV, to each of the evaluated projects. And, uh, the probability pCV_{TI}^{PP} to generate portfolio value, is calculated from the probability of each one of the projects, weighted with respect to the potential benefits of each one of them,

$$pCV_{TI}^{PP} = \frac{\sum_{j=1}^m (B_j^{Py} * pCV_x^{Py})}{B_{TI}^{PP}}.$$

In the P3S-VB model, the selection of IT projects is based on the actual implementation options of each project. Where, each of these options are related to the levels of technological development, in which technological capabilities can be incorporated, generating value. That is, according to the actual configurations or feasible ALoTI levels within the value creation range $[ALoVI_{\min}, ALoVI_{\max}]$.

In other words, ALoTI's real options, in addition to being feasible scenarios for generating value at the project level, broaden the organization's spectrum of value creation and capture in the overall portfolio. They displace in the selection of the projects, the decisions based on the obligation to select or not an initiative, when granting the company, the right to incorporate a greater number of capacities in an appropriate level. Therefore, the ALoTI is a right, not an obligation, in portfolio selection, to incorporate one or another appropriate level of capabilities required to contribute to the materialization of strategic and organizational objectives, as well as to maximize the use of company resources.

The feasible levels of ALoTI in a potential project, when analyzed from the perspective of the real options (Kodukula, 2006), grant in the selection of the portfolio, the following decision rights to maximize the value:

1. Select or not the project at the $ALoTI_{\text{optimum}}$ level or at the $ALoTI_{\text{maximum}}$ level.
2. Select or not the project at an $ALoTI_{\text{initial}}$ level (it may or may not be the $ALoTI_{\text{minimum}}$) and grant the right to decide in the future, according to the roadmap, to expand the ALoTI level.
3. To wait or not to select the project for an initial period and grant the right to decide in the future, according to the road map, to analyze its selection.

For this reason, the P3S-VB model prioritizes and selects the components of the complementary portfolio: (a) quantitative project indicators LoV_x^{Py} and PVC_x^{Py} , (b) with qualitative criteria and factors, framed in the calculation of the probability of generating value in the project pCV_x^{Py} , (c) giving the company the right to select a portfolio that maximizes the materialization of organizational purposes and the use of resources, through the real options that expose the different levels of ALoTI within the value creation range of the project $[ALoVI_{\text{min}}, ALoVI_{\text{max}}]$.

The P3S-VB model contemplates the selection of the projects, in two phases. The first phase is to define the projects that will make up the different portfolio scenarios and the associated ALoTI. And, according to the selection criteria defined by the company, choose the scenario that maximizes the value to be generated and the use of resources. These purposes are achieved with the objective function, shown in Equation 5, and through the project selection algorithm for increasing the value of the IT portfolio.

The second and final phase in the selection of projects from the portfolio to be implemented is to prioritize potential projects. This prioritization is done according to the value capture level calculation

$$\overline{LoV}_x^{Py} = LoV_x^{Py} * fDM_x^{Py}$$

where, fDM_x^{Py} is the value maximization factor of the project, which represents the relationship between the probability of generating value in the project pCV_x^{Py} with respect to the whole portfolio,

$$fDM_x^{Py} = \frac{pCV_x^{Py}}{pCV_{TI}^{PP}}.$$

Equation 5 describes the objective function for maximizing the value to be created from the portfolio, $\max Val_k^{PP}$.

Equation 5. Objective function for the maximization of the value in the PPS. Model P3S-VB.

Model P3S-VB

$$\max Val_k^{PP} = \max \sum_{j=1}^m p_{i,j} * Val_{i,j}^{Py}; \quad \forall p_{i,j} \in Py_{i,j} \quad (a)$$

Subject to:

$$\sum_{j=1}^m p_{i,j} * R_{i,j}^{Py} \leq R_{max\_assign}^{PP} \quad (b)$$

where: $i = (1, \dots, n)$ is the project i within n -element proposed in the portfolio.

$j = (1, \dots, m)$ is the level j of ALoTI within the m -most possible of the project i .

$k = (1, \dots, p)$ is the portfolio scenario k , within the possible and feasible p -threes.

$p_{i,j} \in Py_{i,j}$ represents the binary selection variable of project i at level j of ALoTI.

$$p_{(i,j)} \in \{0,1\}$$

Source: Malagón-Barinas (2018, p. 318)

The k -portfolio scenario, in which value is maximized, is that integrated by a subset of projects. PP_k^{TI} in which the sum of the value to be generated from all its components is the maximum, within all possible project configurations -ALoTI-portfolio.

$$PP_k^{TI} = \left\{ p_{i,j} * Py_{i,j} \right\} \in Py_{i,j} \left| Val_k^{PP} = \max \sum_{j=1}^m p_{i,j} * Val_{i,j}^{Py} \right.$$

The maximum value scenario to create, as shown in Equation 5 (b), is subject to the sum total of the resources required for its execution $\sum_{j=1}^m p_{i,j} * R_{i,j}^{Py}$ is less than or equal to that defined as a restriction or

limiting by the organization, $R_{max\_assign}^{PP}$. The P3S-VB model contemplates each project generating value i , ($i= 1 \dots n$), from the perspective of the different feasible alternatives of incorporation $Py_{i,j}$. Each implementation scenario of a possible project, $Py_{i,j}$ is directly related to level j of ALoTI, ($j= 1 \dots m$). Here, the feasible alternatives for incorporating the $Py_{i,j}$ are subject to the project i at level j of ALoTI_ j is mutually exclusive of feasible alternatives at different levels of ALoTI, and that each level j of ALoTI is in the range of value creation $[ALoVI_{min}, ALoVI_{max}]$.

The value to be generated in the project i from alternative j that will make up the portfolio, $Val_{i,j}^{Py}$ corresponds to the net present value (NPV) of all resource flows to be allocated $R_{i,j}^{Py}$ and benefits to be generated $B_{i,j}^{Py}$ adjusted by the probability of generating value with the project, $pCV_{i,j}^{Py}$. It means, the $Val_{i,j}^{Py}$ is calculated according to equation 6.

Equation 6. Calculation of the value to be generated by a project.

$$Val_{i,j}^{Py} = VPN \sum p_{i,j} CV_{i,j}^{Py} * (B_{i,j}^{Py} - R_{i,j}^{Py})$$

Source: Malagón-Barinas (2018, p. 319)

In turn, $p_{i,j} \in Py_{i,j}$ represents the binary selection variable of project i at level j of ALoTI. So, $p_{i,j}=1$ indicates that project i will form that portfolio scenario to incorporate the technological capabilities at level j of ALoTI. Yes, $p_{i,j}=0$ refers to the fact that this alternative and project is not part of this possible portfolio.

The objective function of maximization, equation 5, considering the set of alternatives through which projects can be implemented, according to their level of ALoTI, represents a very important challenge of execution and use. This is due to the fact that the search for the portfolio scenario where the portfolio is maximized. Val_k^{PP} requires the evaluation of all possible combinations of $Py_{i,j}$.

For example, if the bank of potential projects is made up of only four projects ($m = 4$), and each project i can be configured at maximum three levels of ALoTI ($n=3$), there will be at least 81 ($m*n^m$) possible mutually exclusive portfolio scenarios. Yes, the bank of potential projects is ten, the portfolio scenarios to calculate and analyze amount to 590,490.

APPLICATION OF THE MODEL

In this section the H1, H2 and H3 hypotheses will be validated applying the P3S-VB model in the selection of 53 projects postulated to the portfolio in the company COL during the year 2017. The aim is to validate the fundamental constructs of the P3S-VB model, i.e. the ALoTI and ALoVI.

Below is a description of the sample of 53 projects in which the P3S-VB model was applied for the selection of the IT portfolio of the company COL in the year 2017:

1. The bank of potential projects for portfolio selection consisted of 53 proposals. These were structured to be executed in the period 2018 to 2020.
2. Each of these potential projects set out in a financial model the business case elements associated with investments, operating expenses, and potential benefits.
3. The Present Value VP was calculated, discounted to the company's WACC³ and considering the effect of macroeconomic variables. The VP was calculated, separately, for all investments and operating expenses, and on the other hand all benefits.
4. The 53 projects were analyzed individually using the P3S-VB model. For each of them, the level of LoV value creation associated with each of the technical and business capabilities defined in the scope of the project was calculated.
5. Table 5 indicates the scope of these 53 projects. The quantity of technical capabilities per project to be incorporated varied from 4 to 10.7 on average. And, the Potential Value to be Created PVC between 0.72 to 2.01 times the value of the investment requested.
6. Also, the Table 5 shows that total planned resources required by all 53 projects were 380,746 investment units. And the Benefits identified were 472,600 investment units.

Model P3S-VB

Table 5. Descriptions of the projects before applying the P3S-VB model

		Descriptive statistics							
		N	Range	Minimum	Maximum	Sum	Average	Standard Deviation	Variance
Before applying the P3S-VB model	Planned Resources (Investment Nnits)	53	18.110	1.080	19.190	380.746	7.184	4.014	16.112.045
	No. Capacities in the Original Scope	53	6	4	10	383	7	2	3
	Planned Benefits (Investment units)	53	18.124	1.380	19.504	472.600	8.917	4.742	22.488.535
	PVC(Py)	53	1,28	0,72	2,01		1,27	0,24	0,06
	Planned Value (Investment Units)	53	9.826	-3.275	6.551	91.854	1.733	1.810	3.276.543

Source: Malagón-Barinas (2018, p. 353)

7. The total value of the potential portfolio, before applying P3S-VB, were 91,854 investment units.

Now, applying the P3S-VB model in each of these 53 projects were identified:

1. The value creation range $[ALoVI_{min}, ALoVI_{max}]$; the $ALoTI_{min}$, $ALoTI_{max}$; the probability in the generation of benefits associated with each rTB capacity; and the value potential to be created for each capacity to incorporate PVC^{KT} .
2. The capabilities to be incorporated, investments and associated benefits within the range of value creation. And with this result, each of the 53 projects were redefined, in terms of total investments required, possible benefits to be generated and the estimated value of each of them.
3. The 53 redefined projects were contrasted, in the perspective of the portfolio, and using the diamond of maximization of the potential of value to create, it was proposed the prioritization of projects to conform the portfolio of TI year 2.018 to 2020 in COL.
4. In the Table 6, the data resulting from the application of the model P3S-VB are shown. There, it is observed that the capacities to incorporate belonging to the range of value creation of each one of the projects varied between 2 and 7, with an average of 4.
5. Table 6 shows that the Potential Value to be Created PVC, between 1,46 and 15,85.
6. The total investments required of the portfolio, subsequent to the application of P3S-VB and associated with the capacities that allowed $ALoVI_{max}$ to be reached in each of the potential projects, amounted to 116,4755 investment units.
7. Table 6 also reports that the benefits associated with 381,4186 investment units. And the value to be created by the optimized portfolio, 264,9437 investment units.

Table 6. Descriptions of the projects following the application of the P3S-VB model

		Descriptive statistics							
		N	Range	Minimum	Maximum	Sum	Average	Standard Deviation	Variance
After applying the P3S-VB model	No. Capacities in the Scope at ALoVImáx	53	5	2	7	213	4	1	1
	Resources at ALoVImáx (Unidades de inversión)	53	8.482	176	8.658	116.475	2.198	1.588	2.522.977
	Benefits at ALoVImáx (Unidades de inversión)	53	14.367	1.091	15.458	381.418	7.197	3.755	14.102.881
	PVC(Py) at ALoVImáx	53	14,39	1,46	15,85		4,02	2,32	5,39
	Value at ALoVImáx (Investment Units)	53	12.191	477	12.668	264.943	4.999	2.897	8.390.745

Source: Malagón-Barinas (2018, p. 354)

In other words, and as presented in the Table 7, by applying the P3S-VB model, investments were optimized or avoided for 264,2718 investment units. This optimization is associated with the capabilities or functionalities that did not contribute to the increase of the value potential to be created in each of these projects. And, that eliminating them from the scope did not affect the purposes pursued from these projects to the objectives of the business areas.

Likewise, in the last line of the Table 7 it is indicated that the increase of 173,090 investment units in the value to be created of the portfolio correspond to the optimization of the resources to be invested.

H1 Validation: ALoTI and Value Creation

H1. The required level of technical skills to be developed by IT and DT is directly associated with the creation of value in the case of project business.

Table 7. Descriptive of the contribution to the portfolio when applying the P3S-VB model

		N	Range	Minimum	Maximum	Sum	Average	Standard Deviation	Variance
P3S-VB contribution to the creation of portfolio value	Optimized Investment by P3S-VB (Investment Units)	53	15.839	454	16.293	264.271	4.986	3.524	12.418.461
	Value Created by P3S-VB (Investment Units)	53	9.809	92	9.901	173.090	3.266	2.392	5.721.624

Source: Malagón-Barinas (2018, p. 355)

Model P3S-VB

In order to validate H1, an ANOVA test of equality of means was carried out between four different project portfolio scenarios, differentiated according to the ALoTI level of the technical capacities to be incorporated. The corresponding Ho null hypothesis was as follows:

Ho: The average value to create of the projects in $ALoTI_{min}$ = The average value to create of the projects in $ALoTI_{opt}$ = The average value to be created of the projects in $ALoTI_{max}$ = The average value to be created of the projects in $ALoTI > ALoVI_{max}$.

The results of the ANOVA test, taught in the table 8, indicate that null hypothesis Ho is rejected, since the $P_{Value} = 0.000$ is less than $\alpha=0.05$ for all statisticians evaluated. Therefore, it should be noted that the data from the sample of projects in COL's IT portfolio support the H1 hypothesis.

The table 8 shows that the Levene test is rejected for Ho, because the $P_{Value} = 0.003$ is less than $\alpha=0.05$. Consequently, it cannot be said that there is equality between the variances of the average value to be created by the different portfolio scenarios, according to the level at which the technical capacities are going to be developed.

The results of the ANOVA test on the value difference to be created by the different ALoTI scenarios, allow to indicate that Ho is rejected. This means that there is a statistically significant difference between the value to be created of the projects according to the level of ALoTI in which the technical capacities are developed.

Table 8 (a). Testing homogeneity of variances: validation of the H1 hypothesis

Levine's test	df1	df2	Sig.
4,895	3	208	,003

Table 8 (b). Solid evidence of equality of means: validation of the H1 hypothesis

	Statistical ^a	df1	df2	Sig.
Welch	24,633	3	113,505	,000
Brown-Forsythe	22,713	3	182,701	,000

a. F distributed asymptotically

Table 8 (c). ANOVA: validation of the H1 hypothesis

	Sum of squares	gl	Quadratic mean	F	Sig.
Between groups	414.472.196	3	138.157.399	22,7	,000
Within groups	1.265.197.784	208	6.082.682		
Total	1.679.669.981	211			

Table 8 (d). T3 Dunnett: validation of the H1 hypothesis

Appropriated Level of Technical capabilities to Incorporated		Mean difference	Standard error	Sig.	95% of the confidence interval	
					Lower limit	Upper limit
ALoTI _{min}	ALoTI _{opt}	-2139,758*	488,808	,000	-3451,75	-827,77
	ALoTI _{max}	-2257,734*	491,998	,000	-3578,42	-937,05
	ALoTI > ALoVI _{max}	1008,108	381,534	,055	-14,70	2030,91
ALoTI _{opt}	ALoTI _{min}	2139,758*	488,808	,000	827,77	3451,75
	ALoTI _{max}	-117,976	559,913	1,000	-1618,35	1382,40
	ALoTI > ALoVI _{max}	3147,866*	465,841	,000	1895,32	4400,41
ALoTI _{max}	ALoTI _{min}	2257,734*	491,998	,000	937,05	3578,42
	ALoTI _{opt}	117,976	559,913	1,000	-1382,40	1618,35
	ALoTI > ALoVI _{max}	3265,843*	469,188	,000	2004,13	4527,55
ALoTI > ALoVI _{max}	ALoTI _{min}	-1008,108	381,534	,055	-2030,91	14,70
	ALoTI _{opt}	-3147,866*	465,841	,000	-4400,41	-1895,32
	ALoTI _{max}	-3265,843*	469,188	,000	-4527,55	-2004,13

*. The difference in means is significant at the 0.05 level.

Source: Malagón-Barinas (2018, p. 357)

However, and considering that the Levene test rejected H_0 for homogeneity of variances, the T3-Dunnett test was run to identify the characteristics of the differences between the observed means in the value to be created in the projects.

The results for the T3-Dunnett test are displayed in the table 8. In these it can be observed that except for the difference between the value to be created between the ALoTI_{opt} and the ALoTI_{max}, in the other combinations the difference is always significant.

H2 Validation: ALoTI and Investment in Technical Capabilities

H2. Investment in the development of technical capabilities, above an appropriate level for the organization, does not necessarily increase the value created by IT and DT projects.

To validate H2, a T-Student test of equality of means was performed between the original project portfolio scenario with investments equal to or greater than those associated with ALoVI_{max}; and, the portfolio scenario, for the same projects, but with the associated investments up to ALoVI_{max}. The ALoVI_{max} was used as the decision-making limit in accordance with the definitions of P3S-VB in relation to the range of value creation of the projects.

The null hypothesis H_0 used for this verification was the following:

H_0 : The average investment in the development of technical capabilities, *above* the appropriate level for the organization $ALoTI_{max}$ = The average investment in the development of technical capabilities, *at the appropriate level* for the organization $ALoTI_{max}$.

Model P3S-VB

The results of the T-Student test for H_0 are displayed in the table 9. From these it is concluded that the null hypothesis H_0 is rejected, since the $P_{\text{Value}} = 0.000$ is less than $\alpha=0.05$. Therefore, it is necessary to indicate that the data of the sample of projects of the IT portfolio to be selected in the company COL support the hypothesis H_2 .

On the other hand, the data in the table 9 allow us to conclude that when planning projects within the value creation range $[ALoVI_{\min}, ALoVI_{\max}]$ defined in the PS3-VB model, the value to be created by the portfolio will be increased. This is due to the fact that the requirement of resources to be allocated is reduced, as a consequence of not incorporating capacities whose ratio of benefits to investment is less than one.

Additionally, the table 9 indicate that the difference in means between the average of the resources to be invested in the development of technical capacities is significant. It is also read that the total value captured by the application of the P3S-VB model to this data sample is positive, and that the difference between applying it or not is equally significant. Also, results of the table 9 indicate that investments made above $ALoTI_{\max}$ do not increase the value of the portfolio, in line with the H_1 validation findings.

Conversely, planning projects within the value creation range $[ALoVI_{\min}, ALoVI_{\max}]$ increases the value to be created. That is, when investments in the development of technical capabilities are at the appropriate level for the organization $[ALoTI_{\min}, ALoTI_{\max}]$, the value potential of the projects and therefore of the portfolio can be increased.

Finally, the results figure 15 allow to conclude that:

Table 9. T-student test to validate the H_2 hypothesis

		Levene's test		Independent Samples t Test			
		F	Sig.	Sig. (Bilateral)	Standard Error of Sample-Mean Differences	95% of the confidence interval	
						Lower limit	Upper limit
Resources (Investment Units)	Equal variances assumed	27	0,000	,000	4,986	3,810	6,162
	Equal variances Not assumed			,000	4,986	3,803	6,170
Resources (investment percentage)	Equal variances assumed	112	0,000	,000	2,5%	61,6%	71,7%
	Equal variances Not assumed			,000	2,5%	61,6%	71,7%
Benefits (investment percentage)	Equal variances assumed	0	0,761	,000	4,7%	12,9%	31,7%
	Equal variances Not assumed			,000	4,7%	12,9%	31,7%
PVC (py)	Equal variances assumed	33	0,000	,000	0,32	-3,38	-2,11
	Equal variances Not assumed			,000	0,32	-3,39	-2,11
Total Value (investment percentage)	Equal variances assumed	0,000	0,767	,000	4,5%	-53,3%	-35,5%
	Equal variances Not assumed			,000	4,5%	-53,3%	-35,5%

Source: Malagón-Barinas (2018, p. 359)

1. The required level of technical skills to be developed by IT and DT is directly associated with the value creation of the project.
2. There is a significant difference between the value to be created by developing the technical capabilities in the $ALoTI_{min}$ with respect to whether it is developed at the $ALoTI_{opt}$ and $ALoTI_{max}$ levels.
3. Investments made to develop technical capabilities above $ALoTI_{max}$ create less value than can be achieved by developing the capabilities in $ALoTI_{max}$.
4. The P3S-VB model contributes through the ALoTI and ALoVI constructs to increase the value of IT and DT projects.

CONCLUSION

The use of the DSR-IS in the development of this research contributed to the continuous improvement of the design of the P3S-VB. This, since this methodology proposes an iterative design process, between the stage of development and validation of the artifacts; that in the case of this thesis were, the constructs of the ALoCI, ALoVI and ALoTI, as well as the development of the P3S-VB, the maximization diamond, the objective function and the prioritization algorithm.

The contribution of this methodology, to a major degree, was in identifying the limitations of specific knowledge to the selection of value-oriented IT and TD projects. The gaps identified with the advanced research were: between the level of development of organizational and technological capacities; between the value potential to be created and the appropriate level of resources to be allocated; and between the impacts associated with the capacities to be incorporated, the mechanisms necessary for their measurement, and the capture of value.

It was confirmed that the required level of technical skills to be developed by IT and DT is directly associated with the creation of value in the business case of the project. As well as the percentage of planned benefits transformed into captured value, it increases significantly (65.16%) as project planning is based on alignment to impacts on business capabilities, processes, and objectives, and on determining key value indicators that measure impacts in terms of business.

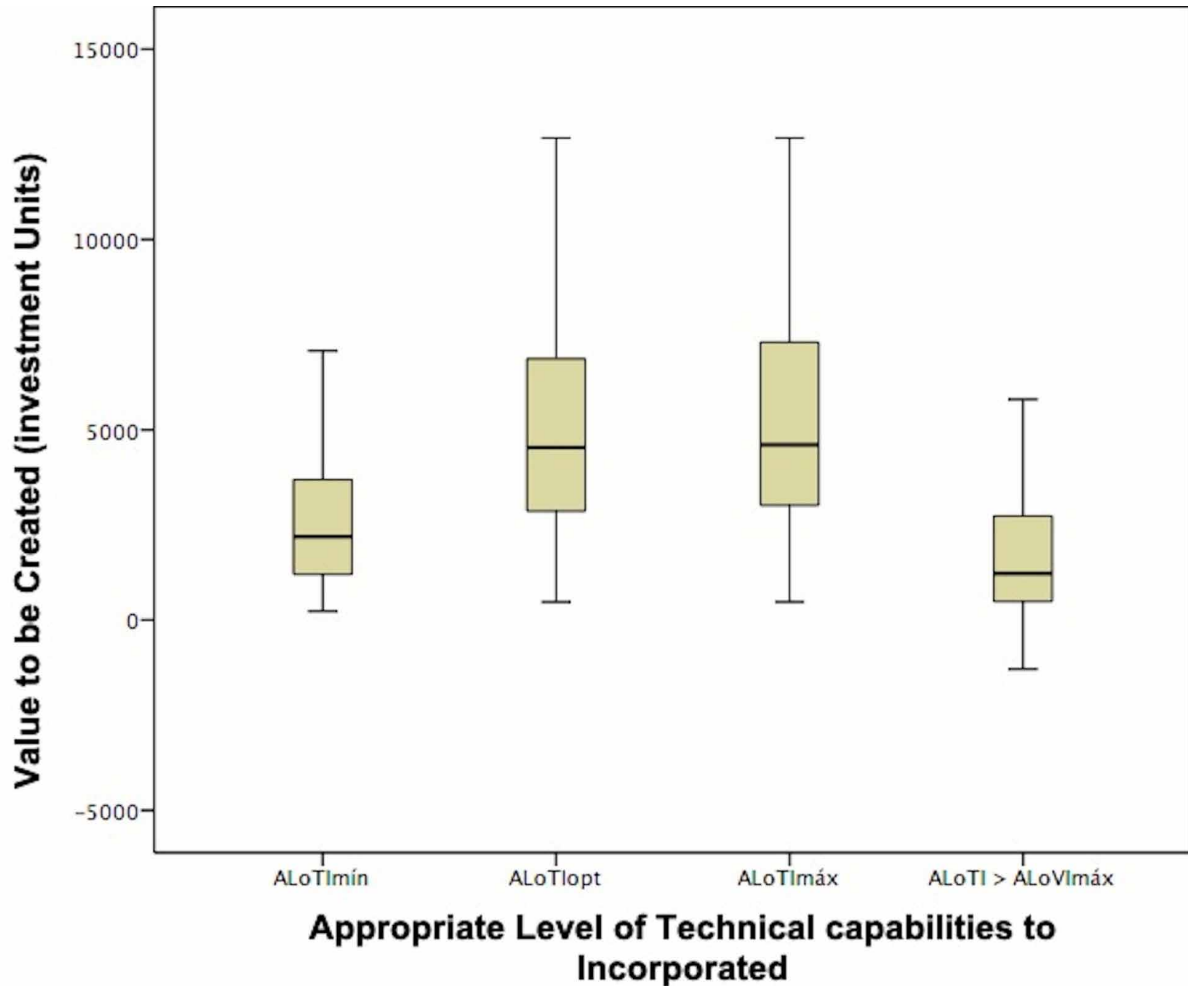
The application of the P3S-VB model showed that investment in the development of technical capabilities, above an appropriate level for the organization, does not increase the value created by IT projects, thereby confirming the constructs defined in this thesis. In addition, it was concluded that there is a range in which projects and portfolio create and capture value. This range is directly related to the differential value contribution of each of the capacities to be incorporated in the projects. Therefore, the application of the model in a practical case, allowed to conclude that the P3S-VB creates value for the portfolio in two ways. The first is associated with portfolio resources that are optimized by avoiding investments in capabilities that do not add value. And, the second is related to the identification of projects in the value creation range, so the total value to be created at the project and therefore portfolio level is broadened.

Briefly:

1. In the incorporation of IT and DT, the important thing is not the set of technological resources involved, but how those resources are used by customers, users and in general by the company to create and capture value.

Figure 15. Relationship between ALoTI and value creation

Source: Malagón-Barinas (2018, p. 358)



2. Profit management is more correlated with success in creating value for the business than with success in project management.
3. Benefit management has a significant contribution in the definition of objectives and products required by the organization and stakeholders.
4. The company captures value, from a minimum level, referred here as $ALoVI_{min}$. This level is from which, the benefits perceived by the interest groups are higher than the cost of the required resources.
5. Likewise, depending on the competencies of the company to capture value, there will be a point from which, the costs allocated to increase the level of incorporation of capabilities are transformed into loss of value for the company $ALoVI_{max}$. That is to say, above that level should not be incorporated technological capabilities or projects.

It is important to note that during the development of the P3S-VB model, the foundation of the ALoTI construct, and the validation of the research products, the researcher identified the following four lines of research. Which would contribute to the discipline of project management, portfolio optimization, and value-oriented IT.

The first line of research can be oriented towards the application of the ALoTI construct at the efficiency frontier of the portfolio (Markowitz, 1952). The central idea behind this proposal is to determine the effects of the ALoTI on the risk level of the projects and the portfolio.

The second line of research can be directed in the application and validation of the diamond of maximization of the potential of value to be created in the portfolio of non-IT projects.

The third line of research can focus on extending the prioritization mechanisms of the P3S-VB model by applying dynamic programming techniques, neural networks, and so many other variations of mathematical modeling.

A fourth line of research can be focused into the application of the P3S-VB model in sectors other than IT, in industries other than oil and in other countries.

Finally, it should be noted that this research expands the opportunity for further studies in the application of the value orientation perspective in project management, portfolio management and selection, process design, and technology management.

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ENDNOTES

- ¹ The word “produced” in this context indicates that benefits are generated if and only if one or some of the different stakeholders make use of the incorporated positive improvement.
- ² LoV: Level of Value is a term defined in the development of the P3S-VB model that indicates the proportion of value that is created in a technical capacity with respect to the total to be created in the project. As well as, the participation in value to create of a project in the totality planned at portfolio level.
- ³ WACC. Weighted Average Cost of Capital. This is the discount rate used to discount future cash flows when valuing an investment project.

Chapter 6

Influence of the Capability for Change on the Explanatory Processes of Change: Proposal of a Model

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ABSTRACT

Early research on organizational change emphasizes the importance of change management. They offer a range of managerial practices that allow the organization to carry out its changes, which is more in line with a planned process. Such an approach overlooks the fact that organizational change can be explained by other processes such as the political process, the interpretative process, the incremental process and the complex process. Each of these processes offers particular characteristics of change. The observed change was marked by the different characteristics falling within the various explanatory processes of change. Results differ according to the context in which change evolved. Through this paper we seek to understand and explain the results related to the existence of different characteristics that are part of the different explanatory change processes (political, interpretative, incremental and complex processes) in a change planned by the senior management of a company.

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INTRODUCTION

Early research on organizational change emphasizes the importance of change management.

They offer a range of managerial practices and actions that enable the organization to carry out its changes which are more in line with a planned process. Such an approach neglects the fact that organizational change can be explained by other processes such as the political process, the interpretative process, the incremental process and the complex process (Vas, 2005; Vas and Jaspart, 2010; Pichault, 2013). According to Van de Ven and Poole (1995), these processes represent theoretical models developed to understand how organizations change. Thus, the explanatory process of change can be defined as a modeling of the progression of change.

Empirically, the observation of change cases has shown that the change has not followed the intended path. The change has rather been marked by the different characteristics of the explanatory processes of change. Results differ according to the context in which change evolved (Beldi, 2004; Cicconi and Soparnot, 2010; Vas and Jaspart, 2010; Pichaut, 2013). This observation marks the evolution of thinking from “change management” to “capability for change” (Rondeau, 2008). Indeed, recent works emphasize the importance of the capability for change to explain tolerance and the organization’s openness for change. However, these works are very limited and do not clearly explain the nature of the influence of the capability for change on the evolution of organizational change. Thus, it would be very interesting to better explain the importance of the capability for change throughout the process of change. This research contribution will allow better management of projects introducing organizational change.

This research work seek to understand and explain the results related to the existence of different characteristics of the explanatory change processes (political, interpretative, incremental and complex processes) in a context of a project of change decided and planned by the senior management of a company. Specifically, this research aims to specify the contribution of the capability for change to the explanation of change. The objective is to develop a research model presenting the components of the capability for change that can influence the explanatory processes of change.

THEORETICAL FRAMEWORK

The theoretical framework of this research is structured in two sections. In the first the different explanatory processes of change are presented. The second is devoted to defining the capability for change.

Explanatory Processes of Change

A review of the literature shows the existence of five explanatory processes, each presenting the particular characteristics of change (Vas, 2005; Vas and Jaspart, 2010; Pichault, 2013):

- The planned process is characterized by the succession of phases, the setting of objectives and the foreseeable results;
- The political process is characterized by continuous negotiation between the various influential actors within the organization in order to ensure a certain convergence of interests;
- The interpretative process is characterized by taking into consideration the actors’ interpretations during the change;

- According to the incremental process, the organizational change underway is influenced by past change experiences within the company;
- The complex process is characterized by the appearance of unexpected results and unpredictable consequences.

The examination of some empirical results shows that the change is marked by the different characteristics of the five explanatory processes of change (Beldi, 2004; Vas and Jaspard, 2010; Pichaut, 2013). In order to understand what determines the coexistence of these processes in the explanation of the same change, the contribution of works dealing with the capability for change has been mobilised.

Capability for Change

Hafsi and Demers (1997) propose the concept of capability for change as the focus and concern for future works on organizational change. However, they haven't offered a clear definition of this concept. Noting the silence of the literature on defining the capability for change, McGuinness et al. (2002) tried to clarify this concept. According to these authors, the capability for change helps to explain the tolerance and openness of the organization to change. However, this proposed definition is guided by their research objective in the field of marketing.

In their essay on defining the capability for change, Meyer and Stensaker (2006) highlight the importance for the organization to pay particular attention to current operations as well as subsequent changes in the implementation of a large-scale change. Thus, capability for change is "the allocation and development of change and operational capabilities that sustain long-term performance" (Meyer and Stensaker, 2006, p.220). These authors mention that this definition concerns only large-scale changes.

According to Soparnot (2011, p.642), the capability for change is defined as "the ability of the company to produce matching outcomes (content) for environmental (external context) and/or organizational (internal context) evolution, either by reacting to the changes (adaptation) or by instituting them (pro-action) and implementing the transition brought about by these changes (process) in the heart of the company". By this definition, Soparnot (2011) has emphasized the importance of the role of the organization in the adaptation to change and/or its initiation without further developing the importance of the actors' role. This aspect is taken into consideration by Autissier and Vandangeon-Derumez (2010, p.3) who define the capability for change as the aptitude of the organization and the actors that compose it to create the conditions conducive to continuous change, to promote its deployment and its integration into the very functioning of the organization. Following an empirical study, these authors add that the capability for change is also a manufacturing process of change specific to each organization that is constantly renewed and rebuilt (Autissier and Vandangeon-Derumez, 2010, p.27).

The capability for change enables the company to remain competitive, compared to others, through an effective leadership style, a culture of adaptation, resilient employees, and an infrastructure conducive to change (Judge et al., 2009). According to Judge and Douglas (2009), this is a combination of managerial and organizational capacities that allow the company, in comparison with its competitors to adapt more quickly and more effectively, to changing situations.

As a summary, the capability for change can be defined as:

- An aptitude of the organization to adapt to change or to initiate it;

Influence of the Capability for Change on the Explanatory Processes of Change

- a combination of managerial and organizational capacities allowing the company to adapt to change;

As a result, an organization's capability for change is made up of several components.

Table 1¹ presents the work dealing with the components of the capability for change.

The existence of different components, depending on the research, could be explained by the following reasons:

- Research on identifying the components of the capability for change is still in an exploratory phase (Judge and Blocker, 2008; Klarner et al., 2007; 2008; Judge and Douglas, 2009; Autissier and Vandangeon-Derumez, 2010; Judge, 2011; Soparnot, 2011).
- The majority of the results are based on case studies and, as a result, on very specific contexts.
- Organizations have different capabilities for change that depend on the organizational context (Meyer and Stensaker, 2006).

The aim is to propose a research model presenting the components of the capability for change that can influence the explanatory change processes. To do this, a qualitative exploratory study is conducted in a leading Tunisian bank during the implementation of its transformation program of 2008-2012.

Research Methodology

In this section the research method, the research context within Basic Bank, the methods of data collection and the coding device are respectively presented.

Table 1. Components of the capability for change

Components of the capability for change	Authors
Leadership	Yeung and Ready (1995); Oxtoby et al. (2002); McGuinness et al. (2002); Hazy (2005); Klarner et al. (2007, 2008); Wei et al. (2007); Judge and Douglas (2009); Kivipöld and Vadi (2010); Cicconi and Soparnot (2010); Soparnot (2004, 2009, 2011)
Staff recognition	McGuinness et al. (2002); Oxtoby et al. (2002); Lawler and Worley (2006)
Communication	Frahm and Brown (2005); Chew et al. (2006); Judge and Douglas (2009)
Commitment to change	McGuinness et al. (2002); Oxtoby et al. (2002); Judge and Douglas (2009); Cicconi and Soparnot (2010)
Organizational learning	Soparnot (2004, 2009, 2011); Klarner et al. (2007, 2008); Wei et al. (2007)
Structural flexibility	Soparnot (2004, 2009, 2011); Wei et al. (2007); Klarner et al. (2007, 2008); Cicconi and Soparnot (2010)
Sense of urgency for change	McGuinness et al. (2002); Oxtoby et al. (2002)
Perceived legitimacy of change	Soparnot (2004, 2009, 2011); Klarner et al. (2007, 2008); Cicconi and Soparnot (2010)
Measure of progress	McGuinness et al. (2002); Oxtoby et al. (2002)
Value of change	Soparnot (2004, 2009, 2011); Klarner et al. (2007, 2008); Cicconi and Soparnot (2010)
Culture of change	Soparnot (2004, 2009, 2011); Klarner et al. (2007, 2008); Cicconi and Soparnot (2010)
Trust	Soparnot (2004, 2009, 2011); Klarner et al. (2007, 2008); Cicconi and Soparnot (2010)

Research Method with a Unique Case Study

Understanding and determining the components of the capability for change and the explanatory change processes require the collection of longitudinal data through the analysis of several past experiences of change in the company (Vas, 2005; Vas and Jaspert, 2010; Klarner et al., 2007; Soparnot, 2011).

The adopted research strategy should give importance to the relationship between the actors and the context in which they interact. The qualitative approach by unique case study makes it possible to understand the functioning of the organization taking into account the specificities of its context (Yin, 2003). According to Miles et al. (2003), the qualitative approach by case study constitutes a mode of research which makes it possible to take into account the complexity of the phenomena. The chosen method is the unique case study (Yin, 2003), and more precisely the longitudinal case study because it allows the study of phenomena over time (Thiétart, 2003).

The choice of the case is dictated by the research question that requires the observation of an organization having achieved the status of a successful company in terms of change to ensure the existence of the capability for change (Soparnot, 2011). The latter is evaluated by the number of years of existence and the extent of experienced changes

Basic Bank, the leading Tunisian private bank has interesting features for this research.

Presentation of the Basic Bank Case

Established in 1976, Basic Bank is the leading Tunisian private bank and one of the largest financial institutions in North Africa. It offers its customers (individuals, SMEs and large companies) a range of products both complete and innovative for its activities in Tunisia and internationally.

According to the internal documents, it is often a pioneer in introducing new banking products and services to the Tunisian market (for example: bank cards, remote banking products and bank insurance products). Basic Bank employs 2454 employees and relies, among other things, on a network of more than 1000 correspondents throughout the world. It establishes transformation programs that bring several change projects that take them over several years. The transformation program of 2008- 2012 touched all of the bank's businesses and resulted in the definition of a strategy centred around (Internal documents):

- Production and network development;
- operational excellence;
- setup of a new organization around three business poles (retail banking pole, commercial banking pole and investment and financing banking pole) and central functions organized into departments, grouping central directorates and directorates presenting homogeneous activities;
- definition of a network development plan over 5 years;
- definition of a marketing plan and a communication strategy;
- Information System (IS) redesign project.

The study of the specificities of all the projects of this transformation program as well as of other past change projects experienced by the bank has made it possible to determine the components of Basic Bank's capability for change and explanatory processes of its changes.

Data Collection

The data collection is performed by a non-participant observation, a documentary analysis and semi-directive retrospective interviews.

As a first step, the data collection is started by a keyword-based web search which allowed having external documentation and collecting various information about the bank in particular, and about its sector in general.

Then, an interview is carried out with the deputy director of the IT department which made it possible to locate the general functioning of the bank as well as its projects, the types of projects in progress, and the nature of our intervention in the bank.

Subsequently, a three-month internship was conducted at the bank's headquarter. During this period, an analysis of internal documents related to several change experiences as well as of other documents from the bank's archive is carried out in order to trace the history of the changes, their contents and the main events encountered by the bank. The analyzed documents are:

- The speeches of the Chief Executive Officer (CEO) and the Chairman of the Board of Directors (CBD), announced on the occasion of the opening of the Ordinary and Extraordinary General Meetings over a period of nine years;
- Eleven interviews, with members of the IS redesign project team, published on the bank's internal website;
- Documentary analysis over a period of nine years: annual reports, organization notes, shareholder letters, newsletters, internal magazine and other internal documents;
- Electronic press articles on Basic Bank (Web manager Center, Business News, African Manager, Leaders).

This step was completed by five retrospective semi-structured interviews with five of the bank's executives involved in the change projects. Each respondent was asked to describe the progress of one or more lived change experiences (restore the story of a change), to evaluate the change (its results, its effects) and to explain why it is positive/negative. Finally, the discussion is geared towards the transformational program of 2008-2012 (description, evaluation, how it is conducted, and success factors). In this last step, the objective was to leave a large latitude to the interviewees in their responses to allow the emergence of data.

The analyzed change experiences are:

- The history of various changes experienced by the IT department (changes in work processes, department structure);
- telecompensation project (reform of 2003, reform of 2011);
- IT project in 2005 (implementation of a technology for the Human Resources Department).

Observed facts, remarks, comments and interpretations from exchanges with staff as well as informal discussions are systematically recorded in a research journal. All interviews lasted between one and two hours and were immediately recorded and retranscribed. The collected data were subject to content analysis (Bardin, 1998).

Content analysis is a set of communication analysis techniques using systematic and objective procedures for describing the content of messages, obtaining indicators (quantitative or not) allowing the inference of knowledge relating to the conditions of production / reception (inferred variables) of these messages (Bardin, 1998, p.47). It allows to trace, quantify and evaluate ideas (Leray, 2008).

Content analysis is a technique for studying a “discourse” based on a set of structured procedures including coding the text from theoretical and empirical themes for it to be reduced and organised for analysis (Wacheux, 1996).

Data Coding

As recommended by Miles et al. (2003), the data was condensed by thematic coding. A code start list, before access to the bank, from a literature review was established.

Regarding the explanatory processes of change, the authors chose a more inferential coding in order to identify some patterns that may be accredited to one or the other proposed theoretical process (Vas, 2005). Descriptive inference, a methodological approach inspired from grounded theory (Glaser and Strauss, 1967) and qualitative data analysis techniques (Miles et al., 2003), assumes an interactive relationship between description and explanation (Vas, 2005). This author adds that the descriptive inference also emphasizes the importance of the role of interpretation that allows a better understanding of the studied phenomenon.

The authors have used the indicators proposed by Pichault (2013) who has allowed classifying the interview extracts according to the five explanatory processes of change deduced from the literature. The authors also opted for multiple coding when a segment of text seemed to be able to simultaneously represent several categories in order to avoid “forcing” the data to a particular category (Vas, 2005).

Regarding the capability for change, a list of start codes from a literature review was established (table 1).

This coding system has been modified as and when taking into account all the data during the categorization. Two types of coding were performed (Miles et al., 2003):

- A multiple coding carried out by the researcher to ensure the internal coherence of the coding. All interviews were coded a second time a month later. The confrontation between the first coding and the second coding has defined a reliability coefficient of 90%.
- A multiple coding carried out by a second researcher in order to check the reliability of the coding: extracts taken at random from the interviews are coded by a second researcher in management sciences. The reliability coefficient calculated between encoders is 82%.

The coefficients found are greater than 80%. They ensure a good reliability of the results (Miles et al., 2003).

RESULTS AND DISCUSSION

The results of this research are structured in four subsections. In the first, the different explanatory processes of Basic Bank changes were presented. The second is devoted to identifying the components of Basic Bank’s capability for change. The study of the effects of the capability for change components

on the explanatory processes of Basic Bank changes is presented in the third section. Finally, the fourth section deals with the formalization of the research model.

Explanatory Processes of the Basic Bank Changes

In order to identify the explanatory processes of past changes within Basic Bank, the authors have developed a “checklist matrix explanatory process of change in Basic Bank” (table 2). This matrix gathers two columns:

- **The “explanatory processes of change” column:** in this column, the authors mention the explanatory processes of Basic Bank changes;
- **The “comments” column:** which represents a synthesis based on interviews, observations and documentary analysis.

From Table 2, the authors notice that the five explanatory processes of change identified through the literature review (planned, political, interpretative, incremental and complex) explain past changes within Basic Bank.

The emergence of the planned process as an explanatory process of change within Basic Bank confirms the results of several authors who have observed the importance of planning in explaining the studied change project (Vas and Ingham, 2002; Beldi, 2004; Vas, 2005; Andreeva, 2008; Cicconi and Soparnot, 2010; Vas and Jaspard, 2010; Pichault, 2013).

The political process is marked by the existence of a diversity of involved actors (senior management, IT specialists, consultants ...) (Pichault, 2013). It also explains the emergence of coalitions (Beldi, 2004) as well as the conflicts of interest (Vas, 2005; Cicconi and Soparnot, 2010) during the conduct of change projects.

The importance of the interpretative process lies in its ability to explain the return on the initial planning to modify it according to the circumstances. In this context, Vas (2005) and Pichault (2013) observed that leaders modify their change planning along the way to adapt to events encountered during the progression of change.

Table 2. Checklist matrix explanatory process of change in basic bank

Explanatory processes of change	Comments
Planned process	- The analyzed change projects are divided into phases with the setting of the intermediate objectives (documentary analysis). - Elaboration of specifications, setting deadlines, etc. (documentary analysis).
Political process	Emergence of interest conflicts (2/5 interviewees)
Interpretative process	Explanation of the choices made during the realization of the changes (5/5 interviewees).
Incremental process	- Progressive approach (2/5 interviewed, documentary analysis); - Special attention paid to the conduct of the various change projects to ensure overall consistency (2/5 interviewees).
Complex process	- Appearance of undesirable difficulties and not foreseen by the initial planning (3/5 interviewees, documentary analysis); - Failure to meet deadlines in some change projects (1/5 interviewees, documentary analysis)

The incremental process makes it possible to take into consideration the impact of the conduct of several change projects in parallel within the organization. Pichault (2013) observed the importance of ensuring temporal concordance among the dynamics of the project he studied, the other projects in the organization and the overall strategy.

Finally the complex process explains the events and the unexpected results that occur during the course of change. This result corroborates that of Vas and Jaspart (2010) who observed, in their study, unexpected events that pushed the project away from its initial planning.

Components of Basic Bank's Capability for Change

The determination of the components of the capability for change is based on the detection of regularities (Soparnot, 2004). In other words, the factor that reflects the bank's openness to change that is identified in at least two different change experiences is considered a change capability component. This is facilitated by the preparation of a starting list of the different capability change components through literature review (table 1).

In order to identify these components the authors have developed a "Checklist matrix of the change capability of Basic Bank" (table 3). In this matrix, "comments" represent a synthesis based on interviews, observations and documentary analysis.

Table 3 shows the existence of eight components of Basic Bank's change capability. Seven of them corroborate the results of previous work (McGuinness et al., 2002; Oxtoby et al., 2002; Frahm and Brown, 2005; Lawler and Worley, 2006; Wei et al., 2007; Klarner et al., 2007; 2008; Buono and Kerber, 2008; 2010; Judge and Douglas, 2009; Soparnot, 2011). However, the authors have registered a new specific component to this bank, namely recruitment.

According to Lawler and Worley (2006), recruitment is important for organizational change success. Kotter (1991) recommends to the organization strengthen its staff through new recruitments in order to manage change. However, research on organizational change capability does not propose recruitment as a component of this capability (McGuinness et al., 2002; Soparnot, 2004; Wei et al., 2007; Thompson Robert, 2008; Judge and Douglas, 2009). Only Meyer and Stensaker (2006) consider the recourse to external consultants as temporary hiring can increase the capability for change.

The importance accorded by Basic Bank senior management to recruitment is at the origin of its proposal as a component of Basic Bank's capability for change. Indeed, recruitments allow the bank to better realize its strategic projects.

Capability for Change and Explanatory Processes of Change

Throughout this research, the authors have aimed to understand how the change capability influences the change explanatory processes. The achievement of this objective requires the identification of the change capability components that can influence the explanatory change processes. To do this, the authors have developed a "matrix of the effects of the change capability components on the explanatory processes of Basic Bank changes" (table 4).

According to this matrix, only the components "leadership", "communication", "staff recognition" and "organizational learning" can influence the explanatory processes of change. These latter are not influenced by either the "commitment to change", the "structural flexibility" or the "culture of change" components.

Influence of the Capability for Change on the Explanatory Processes of Change

Table 3. Checklist matrix of the capability for change of basic bank

Components of the capability for change	Comments
Leadership	- Decisions for implementation of change projects (5/5 interviewees, documents analysis CEO's speech analysis the in the Ordinary General Assembly (OGA) and in Extraordinary General Assembly (EGA)). - Planning changes (5/5 interviewees, documents analysis, the CEO's speech analysis in the OGA and in EGA); - Leadership capability is apprehended at several levels: Senior Management, General Secretariat, Department Heads, Area Directors, Division Heads, Service Directors, Agencies Heads ... (Observation, documentary analysis).
Communication	- Monological communication on the changes progress (internal website, organization notes, internal journal, ...) (5/5 interviewees, observation, documentary analysis); - Dialogic communication (information meetings, functional committee meetings) (5/5 interviewees, observation, documentary analysis).
Staff recognition	- A monetary recognition attributed to all the members of the analyzed change projects (5/5 interviewees); - The recognition of the staff' efforts makes it possible to channel the actors' efforts towards the achievement of the change objectives (3/5 interviewees).
Commitment to change	- All change projects are decided by the members of the board of directors. The change is, in a way, imposed and employees are forced to join it (5/5 interviewees); - A strong commitment on the behalf of the end users to the change induced by the IS redesign project (Survey on the bank internal site, the CEO's speech Analysis in the OGA and in EGA).
Structural flexibility	- Several changes (yearly) in the organization chart (documentary analysis, especially monitoring the evolution of the organization chart over the nine years); - The opening of 10 branches per year (the last five years) (documentary analysis); - The Establishment of two new directorates (transformation direction, IS redesign direction) devoted to managing the changes induced by the transformation program (documentary analysis).
Culture of change	- Launching of new products and refitting of others every year (documentary analysis); -The Organizational culture encourages change and innovation (4/5 interviewees, the CEO's speech analysis in the OGA and in EGA).
Organizational learning	The participation of several bank executives in the various change projects with the external consultants allowed them to acquire skills in the field of change (4/5 interviewees).
Recruitment	- The recruitments made since 2009 have been in line with the strategic orientations of the bank based on the change (documentary analysis ;CEO's speech analysis in the OGA and in EGA); - Recruitments (external consultants, internal and external recruitment) are essential to carry out some projects of the transformation program of 2008-2012 (5/5 interviewees).

Formalization of the Research Model

The results of this research are based on the analysis of the following change projects:

- The history of the various changes experienced by the IT department (changes in work processes, departmental structure);
- The telecompensation project (reform of 2003, reform of 2011);
- IT project in 2005 (implementation of a technology for the Human Resources Department).

With the exception of the telecompensation project (reform of 2011), all these projects were completed before 2008. The 24-hour telecompensation project (reform of 2011) is not a part of the transformation program of 2008-2012. It has been imposed by the Central Bank of Tunisia (BCT) which requires

Influence of the Capability for Change on the Explanatory Processes of Change

Table 4. Matrix of the effects of the change capability components on the explanatory processes of basic bank changes

The change capability components	Effects on explanatory processes of change				
	Planned process	Political process	Interpretative process	Incremental process	Complex process
Leadership	- The senior management defines the bank's policy and strategic orientations (documentary analysis). - The senior management, under its responsibility, ensures the implementation of change projects set in the bank's strategy (2/5 interviewees). - Senior management recourses to the international consulting firms to ensure good planning (5/5 interviewees).	- Intervention of the senior management in case of conflicts or disagreements between the people involved in the changes (2/5 interviewees).	- The senior management sends circular notes to the entire bank staff in order to justify his choices and decisions (documentary analysis). - Senior management can review his initial planning to adjust it to new data (documentary analysis).		
Communication	A predominantly monological communication allowing the staff to be informed of the change plannings (existence of a direction of communication, internal Website allowing the diffusion of information to all the personnel).	A predominantly dialogical communication fostering a climate of continuous negotiation between the interests of the various actors (the meetings of the project teams, the discussions within the functional committees, etc.) (1/5 interviewees).			
Staff recognition		The variability in the attributed bonuses generating susceptibilities between the participants and the formation of the coalitions (1/5 interviewees).			
Organizational learning				- The goal of the changes in the IT department was to change existing ways of working (Interview with the deputy director of the IT department). - The steps of the changes made were gradual (Interview with the deputy director of the IT department)	

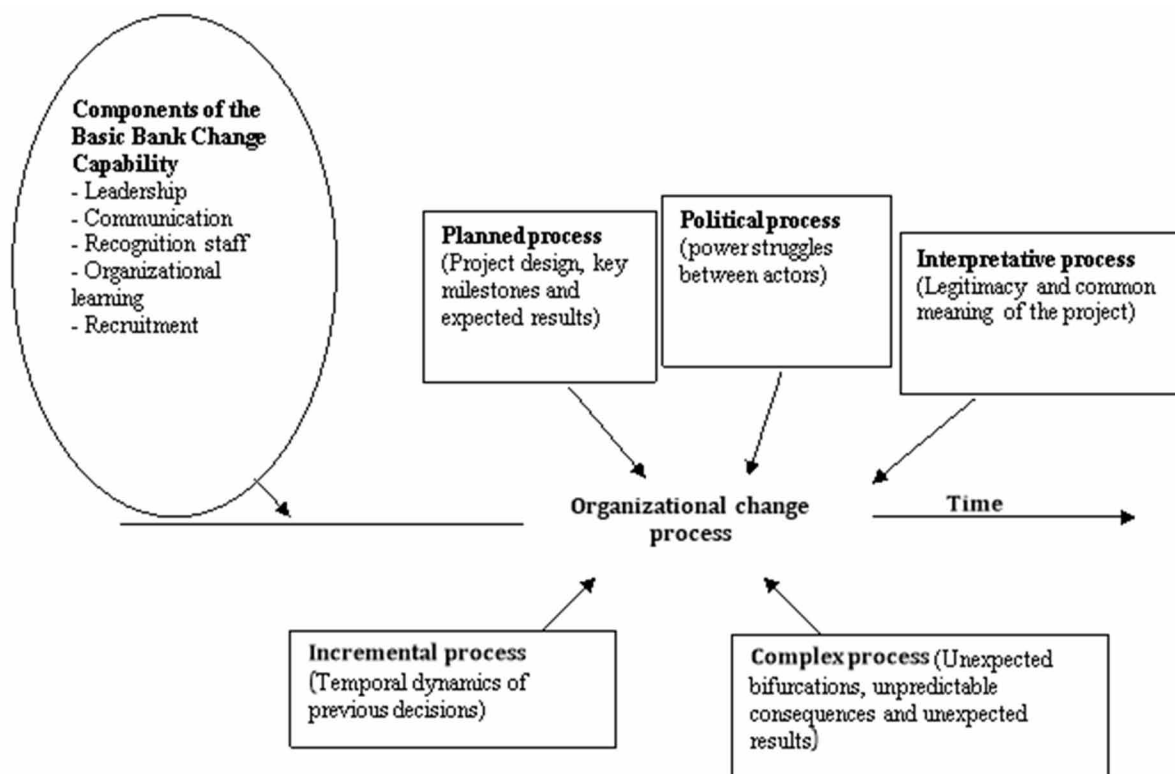
Influence of the Capability for Change on the Explanatory Processes of Change

short lead times for its realization. In carrying out this project, Basic Bank has used neither internal nor external recruitments.

The five interviewees state that recruitment has been essential for the conduct and the success of the transformation program of 2008-2012. However, the results of the effects of the change capability components on the explanatory processes of Basic Bank changes are based on the analysis of data related to completed change projects (made before 2008). Recruitment has been considered important for the bank's change projects after 2008 (transformation program of 2008-2012). Thus, the authors note a major limitation of this study namely: the non-consideration of the new component specific to Basic Bank (recruitment) in the study of the effects of the change capability components on the explanatory processes of Basic Bank changes. To address this limitation, the authors integrate this new component into the research model of this study presented below (Figure 1).

The research model developed following a case study in a leading Tunisian bank proposes that the leadership, the communication, the staff recognition, the organizational learning as well as the recruitment, components of the capability for change, influence the planned, political, interpretative, incremental and complex processes.

Figure 1. Model of the study of the influence of the capability for change on the explanatory processes of change



CONCLUSION

The objective of this research is to formalize a model that identifies the change capability components and that is able to influence the change explanatory processes. To do this, the authors have integrated Basic Bank, the leading Tunisian bank, and analyzed its past experiences of change.

The results showed that the planned, political, interpretative, incremental and complex processes have explained the changes that have taken place within Basic Bank. They also showed that the bank's capability for change is composed of eight components, namely, leadership, communication, staff recognition, recruitment, commitment to change, structural flexibility, culture of change and organizational learning. The study of the "effects of the change capability components on the explanatory processes of Basic Bank changes" has shown that only leadership, communication, staff recognition, organizational learning can influence the explanatory processes of change.

The originality of the proposed research model lies in the fact that it offers a processual and dynamic vision of change. Indeed, the model's field-testing by studying a particular change within Basic Bank will allow to identify the influential components of the change capability according to the evolution of change. This allows the project team to conduct customized management based on the specificities of change and its evolution over time.

The proposed model can be used from the beginning of the change process to recognize the change capabilities available to the organization and those that need to be acquired or developed.

Among the capabilities that can be emphasized, two of them seem particularly important:

- Leadership: the importance of this capability comes from the role it can play in the interpretation of change and the mobilization of actors. Leadership is found in both top management and project teams;
- Communication: the importance of communication across multiple channels stems from the fact that it helps to remove ambiguities especially when categories of different actors speak different professional languages and do not necessarily use the same communication channels.

This model is a diagnostic tool that allows the organization to recognize the capabilities that are mobilized and those that are available to it but that are not being used. Their mobilization can have a positive effect on the process of change and reduce potential conflicts.

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KEY TERMS AND DEFINITIONS

Capability for Change: ability to adapt to changes and / or initiate them.

Complex Process of Change: change is marked by unexpected phenomena, stops and blocking.

Explanatory Process of Change: the modeling of the progression of change.

Planned Process of Change: change is marked by a succession of phases, monitoring of procedures and setting of objectives.

Political Process of Change: change is marked by power struggles and continuing negotiations between the interests of different stakeholders within the organization.

Incremental Process of Change: change is marked by building on previously developed choice.

Interpretative Process of Change: change is marked by a consideration of the actors' perceptions.

ENDNOTE

- ¹ In this table, the authors present a synthesis in which retains only the components cited in at least two different research works. Variables are ranked according to the number of citations.

Chapter 7

Impact of Project Management Offices on Knowledge Management

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ABSTRACT

This applied research work identifies the impact of the project management offices (PMO) on knowledge management among 502 organizations from Colombian enterprises. First, a literature review about PMOs and knowledge management within the project perspective was conducted. Then, a bibliometric analysis was conducted in order to establish the link between this type of offices and the knowledge management on scientific publications about project management. Afterwards, a comprehensive theoretical framework about the matter of study was build. Subsequently, an information gathering instrument was developed in order to collect data for the research. Next, a nation-wide fieldwork was undertaken by analyzing the organizations. Successively, a detailed statistical analysis was conducted in order to identify the impact of the project management offices on knowledge management within the objects of study. Finally, results and conclusions were documented, and future lines of research were established.

INTRODUCTION

From an empirical perspective, it can be said that the project management offices (PMOs) play a fundamental role in managing those endeavors, particularly when analyzing how this kind of departments contribute to the identification, creation, gathering, processing, storage, sharing and managing of knowl-

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edge about projects within enterprises. This nation-wide research identified the positive impact of PMOs on the management of knowledge in organizations from the Colombian enterprise context.

The main objective of this research is to identify the impact of the project management offices on knowledge management. As specific objectives of this study, were defined:

- Conduct a bibliometric analysis about main authors, topics of study and sources about PMOs and knowledge management.
- Develop a theoretical framework about main concepts related to knowledge management and the PMOs.
- Define a research methodology in order to identify the impact of PMOs on knowledge management.
- Undertake a nation-wide fieldwork on 502 organizations that conduct projects in the Colombian enterprise context.
- Apply a detailed statistical analysis in order to identify and document the findings about the project management offices on knowledge in the context of projects.

BACKGROUND

A literature review of 79 scientific publications about PMOs and knowledge management within the project perspective was conducted by consulting Scopus (57) and Web of Science (WOS) (22) databases on the period of time from 2003 till 2018. Publications trend to increase in number from 2010, reaching its pick on 2013 and 2014, and smoothly decrease till 2018 (figure 1).

With the information identified on scientific databases mentioned above, a bibliometric analysis was conducted in order to establish the link between this type of offices and the knowledge management.

Firstly, main topics of research on publications about knowledge management and PMOs were identified: project management, information management, knowledge based systems, human resource management, investments, project manager, risk management, performance, and success (figure 2 and figure 3).

Secondly, key authors, with more citation and publications were acknowledged: Aubry, M.; Glückler, J.; Müller, R.; Lavoie-Trenblay, M.; Marchionni, C.; Richer, M.; and Cry, G. (refer to table 1 and table 2).

Finally, principal sources, with large numbers of scientific publication related to knowledge management and PMOs were highlighted: Project Management Journal, International Journal of Project Management, and International Journal of Managing Projects in Business (table 3 and table 4).

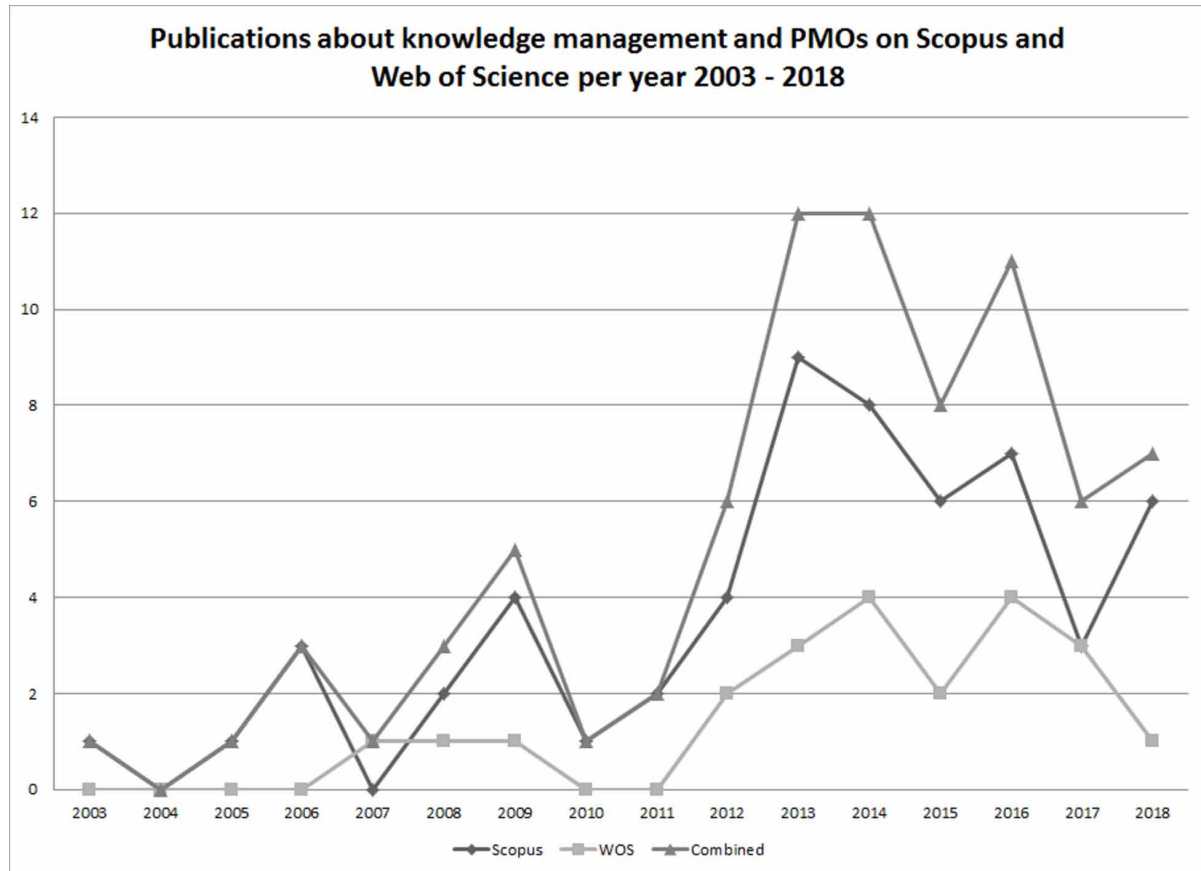
A comprehensive theoretical framework about the matter of study was built by defining knowledge management and project management offices, and the way those terms coexists on the relevant literature of project management:

Definition of knowledge management: as a general term, knowledge is being define as “facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject” (Oxford, 2018 b). In the context of projects, it is defined as “a mixture of experience, values and beliefs, contextual information, intuition, and insight that people use to make sense of new experiences and information [to manage a project properly]” (PMI, 2017, p. 709). An alternative approach defines knowledge as “the collection of information and experience that an individual possesses. For example, understanding the concept of a Gantt chart might be considered knowledge” (IPMA, 2015, p. 15).

The term knowledge shows up when defining project management as “the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements” (PMI, 2017, p. 10).

Figure 1. Publications about knowledge management and PMOs on Scopus and Web of Science per year 2003 – 2018

Source: Developed by the authors with information from Scopus and WOS 2019

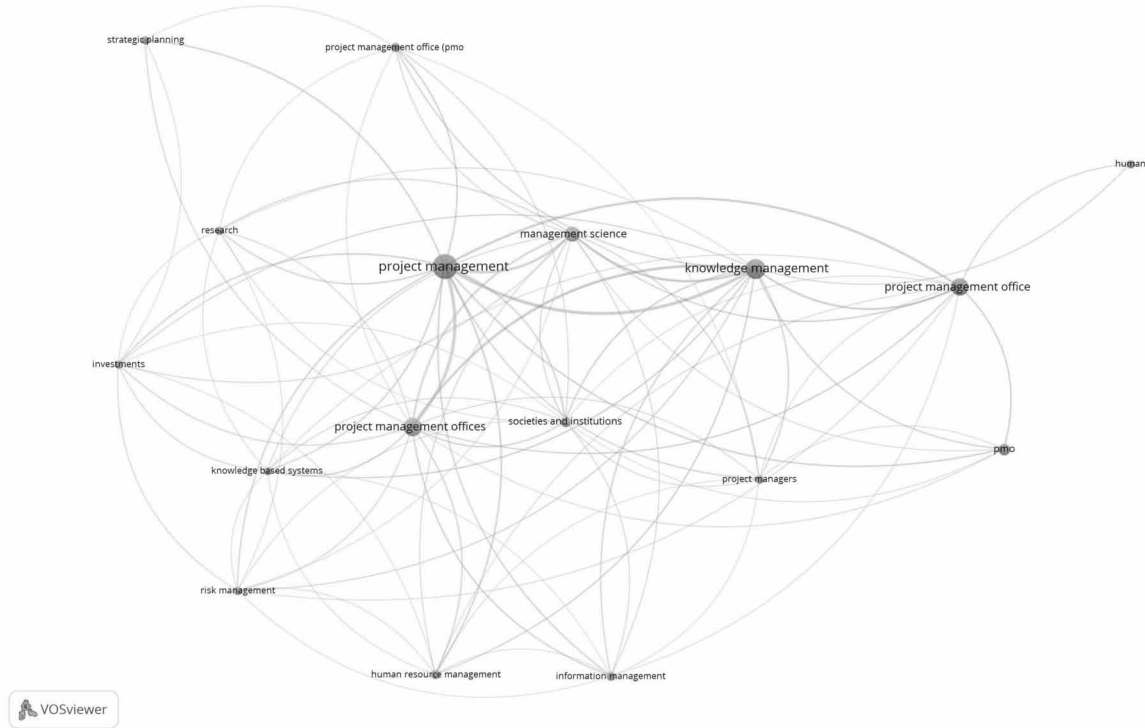


Other definition of project management is “the application of processes, methods, knowledge, skills and experience to achieve project objectives (APM, 2012, p. 241). Knowledge management it is been defined as “the systematic management of information and learning. It turns personal information and experience into collective knowledge that can be widely shared throughout an organization and a profession (APM, 2012, p. 238). Manage project knowledge is defined as “the process of using existing knowledge and creating new knowledge to achieve the project’s objectives and contribute to organizational learning” (PMI, 2017, p. 70). Alavi (1999), Andreu (1999), Herrera (2003), Maestre (2000), Mcelroy (2001), Malhotra (1998), Pan (1999), Saint-Onge (2003), Sveiby (2002) y Wiig (00), accept that knowledge management is integrator process for the stakeholders, where experience, ability and wisdom of the human resources, technology and management of information converge, and it implementation focalizes efforts on to improve high impact process and a better use of knowledge, also it distribution across all organizational levels based on stakeholders’ knowledge, networks, and technological tools.

Definition of PMOs: several scholars had defined de concept of PMOs, Desouza & Evaristo (2006) describe this kind of structures as the repository of knowledge of an organization. Desta, Root, & Diederichs (2006, p. 46) define this term as “the focal point of project management practices and the place

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Figure 2. Main topics of research on publications about knowledge management and PMOs on Scopus
Source: Developed by the authors with information from Scopus (2019) and VOSviewer®



where the knowledge management of the organization and the project management practices converge”. Moreover, The International Project Management Association (IPMA) states that a PMO “enables the development of collective and organizational competencies by joined activities from the individuals assigned to projects and programs” (IPMA, 2015, p. 21). In addition, The International Organization for Standardization (ISO), on 21.500 guidelines, aims that a PMO “conducts a wide range of activities such as governance, standardization, training on project management, as well as planning and tracking of projects” (ISO, 2012 p. 9)). Furthermore, The Project Management Association of Japan (PMAJ) bases its role in a flexible collaboration in order to maximize the effect of project management within the organization (PMAJ, 2001). Other perspective is that a PMO “facilitates the searing of resources, methodologies, tools and technics, and standardizes the process related to projects” PMI (2017, p. 48).

The PMOs and its impact on knowledge management in the context of projects: as a part of the role of hosting project management on an organization, the PMOs introduce knowledge management as a way to add value as “prior organizational knowledge is leveraged to produce or improve the project outcomes, and knowledge created by the project is available to support organizational operations and future projects” (PMI, 2017, p. 98).

Figure 3. Main topics of research on publications about knowledge management and PMOs on WOS
 Source: Developed by the authors with information from WOS (2019) and VOSViewer ®

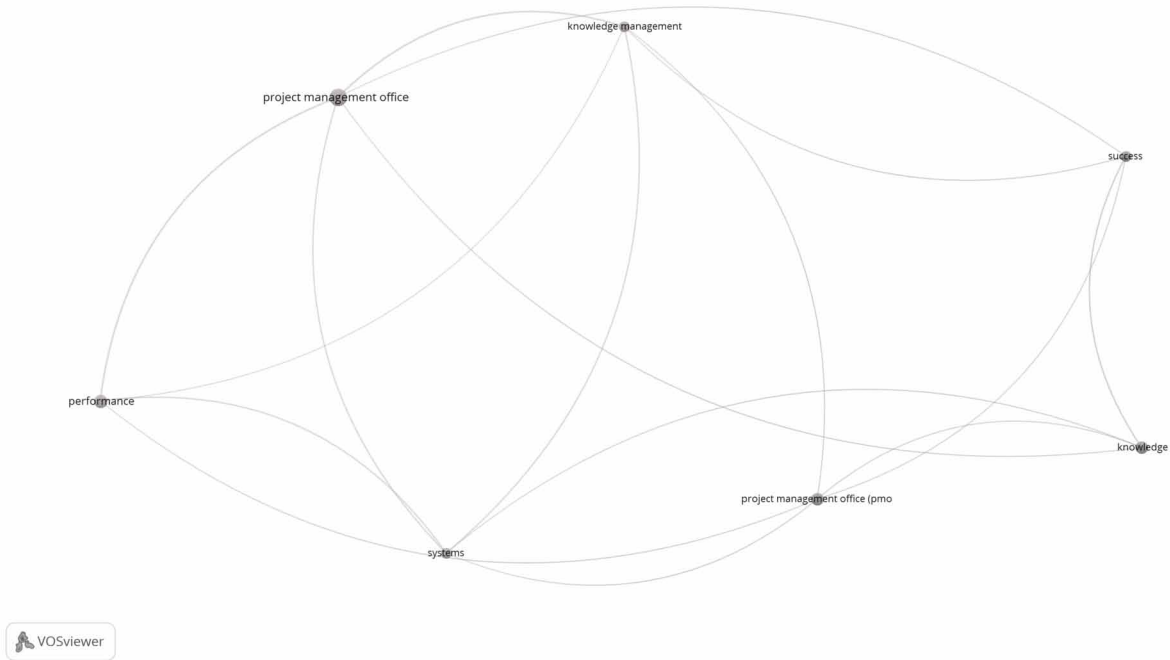


Table 1. Main authors on publications about knowledge management and PMOs on Scopus

Author	Documents	Citations	Total link strength
Aubry M.	6	73	1367
Gluckler J.	3	62	803
Muller R.	3	62	803
Lavoie-Tremblay M.	3	11	614
Marchionni C.	3	11	614
Richer M.	4	12	614
Cry G.	2	8	426

Source: Developed by the authors with information from Scopus (2019) and VOSViewer ®

Table 2. Main authors on publications about knowledge management and PMOs on WOS

Author	Documents	Citations	Total link strength
Aubry M.	4	39	582
Lavoie-Tremblay M.	3	21	556
Richer M.	3	21	556
Cry G.	2	8	353
Marchionni C.	2	8	353

Source: Developed by the authors with information from WOS (2019) and VOSViewer ®

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Table 3. Main sources on publications about knowledge management and PMOs on Scopus

Source	Documents	Citations	Total link strength
Project Management Journal	4	64	119
International Journal of Project Management	2	74	80
International Journal of Managing Projects in Business	2	11	69
Proceedings of the European conference	2	5	64
South African Journal of Industrial Engineering	2	2	64
Journal of Modern Project Management	2	3	44
Eastern-European Journal of Enterprise	3	6	2

Source: Developed by the authors with information from Scopus (2019) and VOSViewer ®

MAIN FOCUS OF THE CHAPTER

According to some methodologies for project management, it can be stated that there are two types of organizations: the ones working by processes, and the ones working by projects. On the first type, it is NOT common to find a Project Management Office (PMO), naturally only until the number of projects to be developed becomes out of control of the top management, and it is there when they include them within the organization structure. For that, they have to start recovering functions which they had shared out within several areas, among them, financial, human resources, operations and some delegated to sub-managers, including risk assessment processes of the PMO project, which is a pattern for other organizations that challenge themselves to participate with effective and collaborative practices in order to improve the project results, increasing the knowledge management. (Taylor et al., 2012, p. 17).

On the second type of organizations, the issue is clear, work has to be managed by projects, and the Top Management in itself, makes up in its next structure level, a Project Management Office (PMO), for it to take care of the integral management of such projects. But it is clear, both types of organizations need a PMO. Now, where should it be started? where should it be located? will it take care or not of the projects execution? or will it be accountable only for a follow up? These questions are to be answered by each organization and its management pattern (strategy, staff and processes), which is well articulated with the knowledge management that provides the organization, a higher level of productivity and competence within the environment of its corporative performance, especially for companies operating

Table 4. Main sources on publications about knowledge management and PMOs on WOS

Source	Documents	Citations	Total link strength
Project Management Journal	3	5	1739
International Journal of Project Management	5	143	168
International Journal of Managing Projects in Business	1	4	83
Inzinerine Ekonomika-engineeing	1	17	81
European Journal of Information Systems	1	25	70

Source: Developed by the authors with information from WOS (2019) and VOSViewer ®

in a multiple project environment (Spalek, 2013, p. 88), promoting the successful organizational change and facilitating practice based on evidence and knowledge. (Lavoie-Tremblay et al., 2017, p. 17).

The scope of the PMO responds to ¿what does it justify it and what are the desired or expected benefits from it? guide it then with the route map, the final services required for the PMO to offer within the organization, emphasizing its potential to act as knowledge mediators between projects and, between projects and the Top Management, preferring prospective learning and the active interchange of a generation of new knowledge, (Pensel, 2013, p. 31). In any case, research states that using PMOs as collaborative learning means or environments, support in parallel, the homologation and standardization of planning processes, execution and project control, generating a favourable environment to use the management tools and facilitators of creation, sharing and transferring of knowledge, through the change of practices, based on evidence and knowledge obtained on the change management with the members of the PMO, (Lavoie-Tremblay et al., 2012, p. 418).

The PMO Project Management Office, is focused on improving the results of project management of the organization, and it emerges when the top management is feeling pain due to not motivating results in the projects execution. The PMO is considered as the services area for projects, and it seeks the improving of the knowledge management on the projects at the management level, from previous initial data for execution of projects, to information determining methodologies and performance of same. According to Bernstein, (2000) quoted by (Rodríguez et al., 2002), in the same way as the discipline of projects management started to be recognized as a specific skill, the PMO started to emerge providing an organizational unit accountable for project management processes. The PMO becomes the home for project managers, where they find the necessary support to manage their projects within the term, cost and quality required by means of using methods and processes of planning, accompaniment and control, approaching the challenges for transformation of the rigid corporative culture, the inability to manage the organizational opposition to change, identifying project managers (PM) with PMO leadership with experience, and covering the lack of a management strategy for an adequate change management (Singh et al., 2009, p. 409). Other than that, the PMO is accountable for the articulation of the Project Manager with the Top Management, through a feedback system that allows the continuous improvement of discipline in the organization. In accordance with (PMI, 2017, p. 20), a project management office PMO, is an organization entity or an entity in charge of several responsibilities related to the centralized and coordinated management of projects under its control. The responsibilities of a projects office may go from the provision of support to the projects management, up to direct responsibility over a project and its production of knowledge, the way the information is treated, communication and knowledge transfer, is of vital importance for the management of organizations that base their management on projects, (Jerbrant, 2014, p. 33).

The scope of the PMO, therefore, may vary from a simple support function to project managers, to guiding in the project's execution and projects portfolios. However, (PMI, 2017) describes the most relevant aspects covered by the PMO, among them: management of shared resources between all projects managed; identification and development of the methodology for projects management, as well as the best practices and standards; encouragement, guardianship, training and supervision of the team; supervision of the projects' auditing, policies of standards fulfilment, development of procedures and use of project management templates; policies, procedures and other shared (corporative assets) and, coordination of communications between projects, suggesting that public and private organizations should expedite the strategic maturity of their PMOs in order to benefit from them, (Khalema et al., 2015, p. 12)

It is important to highlight that, although in defining the PMI, (2017) about the PMO, is assuming the responsibility of executing an active project, it also highlights that there is a clear difference between the project manager and the PMO, since they follow different purposes (see table 5).

Although accountable staff for the project is directly related to the PMO, each one of them has different objectives, one focused on the success of the project, and the other on the global optimization of all projects. The PMO has become an asset, a product to be commercialized, and an emblem to be used in order to obtain certain privileges. The PMO evolved to become the central repository of tools and methodologies, for the optimum performance of the manager in the project management and the generation of new knowledge, translated from the best practices and lessons learnt. (Darling & Whitty, 2016, p. 282).

The PRINCE2 methodology, does not speak directly about a Project Management Office PMO, but it instead defines a Support Office for PSO Projects, an entity accountable for the provision of required resources in order to guarantee the support function to projects, with two objectives: Help the project manager in the handling of his projects and, grant the correct and effective use of the method. PRINCE2 defines the PSO as the entity that guarantees a project management, clarifying that the support concept to the project, deals with assuring a set of support tasks in the execution of projects, through methods and tools: advice about the methods and the distribution of project management tools and, processes directly operational: related to exchange control management, data compilation and reports presentation (Prince, 2009). The project “support role” does not pretend to replace the role of the “project manager”, who keeps full responsibility and authority over the project.

For the Gartner Group, (2014, p. 12) the PMO is defined through five key roles and a segmentation of three categories (see table 6).

Regarding the three categories of the PMO, Gartner defines three main types of PMO: 1) The PMO Library (Repository Project Model): it provides standards and better practices. This allows the PMO to standardize the methods and tools used, without modifying the governing project. This type of PMO is generally the first step to start a PMO more active in the governing project. 2) PMO assistance (Repository Project-Coach Model): it offers a double function; support to projects with managing experience, used by project and, follow-up of projects, assuring centralized reports on their status and, 3) Corporative PMO (Repository Project-Coach-Manager or Enterprise PMO): it is the final stage, adding to previous model, the responsibility of a projects portfolio for which the PMO has authority over the research and approval of projects. This last category of PMO is seen as a logical development which shows the maturity of the PMO, Gartner, (2014, p. 12).

Table 5. Differences between PM and PMO

PM Project Manager	PMO
The Project Manager is focused on the specific objectives of the project.	The PMO is accountable for important changes on the content of the program, which could allow a better accomplishment of the business objectives.
The Project Manager keeps control of resources assigned to the project in order to improve the accomplishing of his objectives.	The PMO makes an optimum use of shared resources of the organization between all projects.
The Project Manager handles the restrictions (scope, time, cost and quality) of individual projects.	The PMO, handles projects, methodologies, standards, opportunities/general risks, and the interdependence between projects at the company's level.

Source: PMI (2017)

Table 6. Five key functions of the PMO

Standard project management	Develop a standard methodology of project management, tools and processes to assure a proper execution of projects within the organization.
Resource evaluation	Evaluate the optimization of organizational resources across projects.
Project Planning	Responsible for the planning efforts of each project.
Analysis and project review	Constant monitoring of projects to assure they are on track and a successful ending.
Execution of assigned projects	Assign a project manager when needed.

Source: Gartner Group (2014)

Also, the corporative PMO, the concept of Strategic PMO is used to identify a PMO more widely involved in the aligning of the project with the business strategy. The PMO is involved in the priority of the company's projects through the establishing of uniform methods for evaluation of these projects. This is used to select the projects offering the greatest value of the company's strategy. Gartner Group, (2014, p. 16).

PMO Objectives

The PMO as a mean to reach the organization's objectives, speaks about fulfilment of them in order to understand the corporate strategy; define approaches and parameters for their justification, selection and priority of initiatives, (EALDE, 2017, p. 1), that is the way the PMO objectives are concrete declarations that describe what it is expected to get in the short, medium and long term. They are described in terms of deliverable with the aim of being evaluated on an annual basis or within the established terms in the projects, in order to verify its accomplishment or in order to take pertinent actions, if any. In any case, objectives should cover the minimum characteristics in their SMART formulation, Specific, Measurable, Achievable, Realistic, Time based, (PMI, 2017).

PMO's objectives, after analysis done in cases applied on this research, are classified as follows: (see table 7).

From the objectives' point of view, a great level of companies has recognized the importance of success in projects as a mean to achieve mission goals and objectives. Due to that, in order to be competitive in the environment of creating knowledge, as support for the development of projects, it becomes essential to count with the technological infrastructure, methodology (PMO) and qualified personnel for the implementation of projects, to reach the project's objectives which get directly articulated with the mission objectives of the organization.

PMO's Customers

Another important factor to be taken into account, is the identification of the PMO's customers (Table 8), since their classification and characterization, support priorities to reach objectives, giving place to a knowledge generation that moves from the tacit to the explicit (Nonaka, 2001, p. 332).

The main duty of the PMO's manager, is the articulation of all described customers, with processes, in order to support the establishing of a project managing culture, as an important and complex. This implies recruiting, selecting and training personnel with technical skills, but also personal, such as

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Table 7. PMO's objectives

General (Braun, 2018); (EADE, 2017)	Facilitate the governing committee. Establish priorities of the projects' portfolio Provide training on project management Manage the information repository of projects. Evaluate tools used in the execution and control of projects. Managing of marketing and communication activities. Updating of time for life cycle of projects. Control of processes related to costs of projects. Define and communicate pertinent corrective actions required on the processes. On-time support of projects having problems.
Related to project cycles (Brandt, 2003); (PMI, 2017)	Assure the processes of the project's plan Assure the commitment of everybody involved in the project's plan Make quality control on projects in order to avoid are work. Make risk analysis on the main components of the plan. Make sure that the procedures for control of currency exchange are strict, implemented and duly adequate. Communicate expectations, progress and problems, periodically. Manage the over-assignment of resources Control wastes when changes on priorities occur.
Related to the right articulation of multi-projects (Suess, 2014)	Keep cohesion between the projects managing and the strategic planning of the organization. Keep the balance of the project in the marketing and production processes. Eliminate and deactivate projects which are not important for the organization.
Related to executive development and control (AMCIS, 2006); (Andersen, 2007)	Provide vital information to executives, managers and projects team. Classify Project portfolios, differentiating the key ones which are related to the resource portfolios, the assets portfolio and the goals portfolio, with the aim of its execution and control.
Related to follow up and report of a high-level progress (Alqubaisi, 2015)	Executives need to know the performance of the finances project. Make sure that the information is accurate, received in due time and easy to use. Help to identify and solve problems and minimize the number of problems addressed to the management office. Guarantee the PMO's survival.
Related to corrective actions and better practices (AlMajed & Mayhew, 2013); (Dai, 2004)	Use the report and the Pareto principle to find the main causes of delays, re-work and other problems. Detect corrective actions of the project related to the organizational level. Eliminate measurements that cause the team to extend the project cycles. Standardize processes, procedures, forms, formats and templates for projects. Train the project team in the topics where failing is detected, and strengthen those that require so. Provide information on changes to improve deliverables. Establish and coordinate the execution of the management plan of the PMO's communications.

Source: Own preparation according to authors.

coaching, communication, attentive listening, knowledge of the organization and its policies and skills to influence on others. On the other hand, it should also try to create, capture, transfer and reuse knowledge to achieve the execution of the project successfully, (Sokhanvar et al., 2014).

Methodology Used by the PMO

The managing methodology of the PMO considers the creation, improvement and administration of project managing processes, as well as the provision of experience on marketing processes, with the aim of assuring predictable results. Generally, organizations assign the PMO with the inherent responsibility the project managing methodology, which includes everything related to processes, procedures, templates, practical improvements, standards, guidelines and policies used for the projects management

Table 8. PMO customer

Sponsor (Martínez & West, 2012)	The most forgotten customer of the organization It is important that the PMO knows about his needs. He is the mediator between the project manager and the board of directors of the organization.
Governing Committee (PMI, 2017); (ISO 21500, 2016)	Formal team made up by executive leaders. His mission is to strategically manage the organization. Uses projects as a mean to measure goals. Provides services related to information, analysis and recommendations. Guarantees that organizations learn how to conduct the business, decisions taking, risks and lastly the responsibility in the proposed services during the development of projects. An efficient projects government assures the strategic alignment, the reaching of promised benefits, a good communication with the interested parties about improvements and problems; that adequate tools and processes are used; that decisions be taken rationally and with corresponding justification.
Project Managers (Milin, 2015)	The PMO helps to listen to their voices up to levels sufficiently high as to solve their main problems. Provide services related to time shortening, transactions and costs, negotiation under conflicts pressure and lack of resources. Offers a complete positive guide based on experience. Present the basic elements of projects, their management and the knowledge management, oriented towards the knowledge transfer between projects and the head organization.
Project Team (Paton, 2019); (PMI, 2017)	Those who ask for help from the PMO They develop important sources of informal information on active projects, morality of the team and other aspects. Establishes an early warning system They channel the longitudinal integration of the activity throughout the life cycle of the project and the product Assure continuity through phases, keeping coherence of purpose, process and method, and integrity of knowledge to improve performance of previous and further phases on the life cycle gap.
Functional Units (PMI, 2017)	They compete with each other for the utilization of resources and assets. They must establish and keep excellent communications They are firsthand support for each functional and project manager.
Resource Manager (PMI, 2017); (Karayaz & Gungor, 2013)	Responsible (with the sponsor's authorization) for the planning and execution of the change project. Most of their activities are centered on the change objectives. Transforms the way of work as a result of change. These are roles extremely important and active during the implementation process. Promulgate the good use of project management through the organization. The PMO on this stage has the function of supporting the organization with tools and techniques to overcome the changes and grant the alignment with strategic initiatives of the organization.

Source: Own preparation according to authors.

(PMI, 2017). The project management office (PMO) is configured out to liberate the contradiction between the business organization and the project organization. A gradual revolution should be done of the organizational structure of the company, in order to reach the managing demand of the expected knowledge by the organization. (Jiang et al., 2014). It is fundamental that the methodology be adapted to the changing needs of the business and deliver added value to projects using it. Since new methods and technologies may emerge, the methodology should evolve to reflect such improvement. The PMO should support and update the methodology, assuring that this is relevant for the organization.

PMO's Tools

Among the PMO's tools there are: expert technicians on the Project Managing Tools, a help desk to solve the execution of processes of the GP, training, proposals for improvement on actual tasks performance,

implementation of new practices as necessary, information systems which manage the projects repository, standardization rules of formats and procedures.

PMO's Structure

According to Leal (2004), having an administrative structure and a direct link which could bring concerns to a directive level, to take the decision that could impact all plans in a coordinated manner, besides the utilization of the best practices, no doubt produces a motivating environment for achievements and results. A PMO may exist in different formats and sizes; be almost non-existent, virtual, or consist of a formal group with great influence in the organization; be limited to perform a supporting role during planning and control of a specific project; or also, be responsible for implementation of strategic projects. In any case, the PMO is related to a central office for project managing whose objective is the reaching of more efficient projects.

The Gartner Group (2014) identified the following PMO models: **Project Repository:** It is a source of information about practical improvements and project managing standards. This model assumes that an organization adopts a set of coherent tools for the design, managing and reporting of projects. This source is more frequently found in organizations where ownership of projects is focused in the business areas, or where they have a feeble central governance. The project chiefs report and are financed by their corresponding areas. **Project Coaching:** Represent a competence center to provide experience and supervision of projects. This model is an extension of the previous model and it is supposed to be willing to share some managing practices of projects, documented through functions and uses of the PMO to coordinate the communication. The best practices are documented and shared, and the project performance is actively monitored. The PMO may manage the project portfolio, but it usually does not have authority to review or approve projects. It tries to increase performance of the organization and train project chiefs without experience or inefficient. Mentoring relations may be established between heads of high-performance projects and the less capable. The PMO of this model is a permanent structure of personnel, and it has some supervision responsibility for all projects. Financing is based on a fixed assignment of personnel and administrative support. **Enterprise PMO:** It counts with a greater authority to evaluate, approve and supervise the organization projects. Its mission implies the direct managing or supervision of projects, evaluating the scope and the resources allocation; verifying terms, budgets, risks and impact. The project managers belong to a shared service and they are assigned as required. The PMO is responsible for the management of the project's portfolio and, its financing generally comes from a combination of fixed budget corresponding to basic services, and from charges for services rendered to others.

Later, Gartner Group, (2014), identifies a fourth way of PMO, **Deliver Value Now:** model that puts the organization's goals in first place. Improvements in the methodology of projects management are seen as a means to an end, and not the end in itself. It is about an approach covering methods, skills and strategy that considers the project management as a piece of a bigger puzzle. It permanently motivates all the organization in the seeking of ways to expedite delivery of the projects, from a stronger and balanced project portfolio, and the improvement of the project's performance.

According to Casey and Peck (2001), quoted in De Marco (2004), the PMO may put focus from the intern processes (planning, people management, execution, exchange control, etc.), up to assume responsibility for external interfaces (customer satisfaction, communication with stakeholders, etc.). On Table 9, different types of PMOs may be appreciated, and problems that each one of them may solve.

Knowledge Management From the PMO

As a result of the research done in this chapter, and with the collaboration of projects that made part of it, the following entries were established: products/services (tangible and intangible) and outputs, as a result of a management process of knowledge approached by the PMO, (see table 10).

The provision of services offered from the PMO to the project team, through collaboration tools, make knowledge to grow up and be appropriate within the PMO. The purpose is oriented towards taking advantage of the best practices in the execution of future projects, granting to increase the number of successful projects.

Additionally, the process of knowledge management is approached by the PMO through a conducting committee of project management, which is in charge of spreading the lessons learnt, keep the information repository updated, and count with a collaborative learning managing process, where starting from training, the best practices and experiences lived, be undertaken and transferred between the projects team and the PMO's customers. Competences gained and new knowledge, with the aim of granting the success of future projects (see table 11).

Table 9. PMO types

PMO Type	Organization's problem	Focus for the PMO
Weather Station	Confusion caused by different types of reports prepared by different project managers, with varied jargon.	This type of PMO: Only informs about evolution of projects, it does not try to influence them. It does not tell the project managers nor their customers how and what to do. It may be responsible for keeping a database with historical documents of projects and lessons learnt
Control Tower	Expensive methodologies and very little used; high executives with little comprehension or wrong vision about project management; lessons learnt not used in new projects; constant use and change of any method and tool.	This type of PMO: Gives direction to project managers Each manager has responsibilities for the flight (follows instructions from the control tower, particularly during takeoff and landing). Establishes the methodology for project managing, (risk management, roles definition and responsibilities, communication, lessons learnt and tools). Is responsible for the internal consultancy, in the sense of guaranteeing that the methodology will be followed, and for the permanent improvement of processes.
Pool of Resources	Organizations whose business is making projects, they need to be permanently attentive to training of their staff in project management. In general, the contracting person and who deals with the project managers, knows very little about the function. On the other hand, it is essential for the company to make a good selection of them, well trained and that they stay in the company.	This type of PMO: • The manager of a PMO tells the project managers when to get in the cockpit and when to takeoff. • The PMO manager is evaluated for his performance on the resources pool. A resources pool may offer a group of project managers with necessary skills to manage the different type of projects for which they were designated, as well as a supervision to guarantee that these skills are effectively applied. • The Pool Manager must be accountable for the designation of managers of corresponding projects, and the pool is the only source available in the company. • No project managers may be contracted unless they are from the pool, or at least, without consulting the manager. The pool manager is the maximum authority with respect to his officials.

Source: Casey & Peck, 2001 adapted by: De Marco, (2004).

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Table 10. Entries, products/services and PMO's outputs

Entries	PMO's Products/Services	Outputs
Report on the status of the project Scheduling of the project Conflict Reports Risk Reports Record data of activities Calls to the Help Desk Projects with problems Lack of training Strategies for the fiscal year Errors detected during the development of activities Lack of templates and formats to record the changes. Inadequate communication of the project team. Segmented information	Training Auditing / Consultancy Good Practices Standardization Collaborative work New knowledge Project documentation Project coordination Resources management Control on cost indicators, time and quality. Project programming Project visibility Evaluation of investment Support to creation of an effective vision of reports. Assistance on the creation of the projects plan Support for the allocation of multiproject resources. Support for the acquisition of resources. Survey on the project's progress. Inspection of methodology used. Administrative support.	Project portfolio Resources portfolio Assets portfolio Portfolio of strategic objectives Integrated portfolio Monthly report of operations planning and predictions. Training program Report on resources allocation. Priorities sheet User's guide of the EPM (Enterprise Project manager) User's guide of methodology for projects management Processes and procedures standardized. Web Site of the PMO organization. Structured Repository of information

Benefits of a PMO

A PMO may provide structure and support for the evaluation, justification, definition, planning, follow up execution of projects of an organization. The following are some of the benefits granted to the organization, (Díaz-Piraquive, et al, 2019):

- Standardization of methodology, procedures, tools and templates for the project management.
- Prioritizes strategies, programs and projects.
- Establish an approach of improvement in the competence of projects management.
- Improves the budget and the compliance of costs execution assigned to the project.
- Improves the quality levels in the project and in the product.
- Minimizes risks and their impact.
- Optimizes communication levels between projects.
- Rationalizes the use of shared resources.
- Generates reliability in the information for the decisions taking within the project or from the top management.
- It gives visibility to projects
- It motivates an adequate administration of the project's configuration, and the deployment of lessons learnt.
- Develops or improves the skills for project management and knowledge through training or mentoring
- Increase the number of successful projects.
- Increases the customer's satisfaction due to the achievement of results.

Table 11. Competences gained and new knowledge

Process/Activity	Description
Project Management Committee	Weekly Committees to which all the support areas and experts in projects attend (ex. Development leader, technology leader, organization leader), in which project blockages and advancement of same are discussed.
PMO Committee	PMO Internal Committees to which only Project Managers attend, where internal problems are discussed about projects, area decisions and changes of the implemented technology, incidents are documented and the best practices are transferred among them and the team members of projects, in order to appropriate and apply them in future projects.
Lessons learnt	Documents required from the projects according to the PMI reference framework, in which achievements and problems of projects are stored, with the aim of spreading them out, appropriate and transfer them to the project's team.
Information Repository	Repository located in a collaborative environment on line, where the actual state of scope is stored, as well as schedules, budget, risks, quality agreements and documents related to processes of project management such as: formats, templates, service guides, methodologies, presentations, bulletins, check lists, proposals, client references, successes achieved, errors corrected, case writing, use, case study, problems solving, training plan, conferences, seminars and events. Likewise, there will be available contact lists, organizational structures, announcers, literature, relevant news, project experiences, software tools and revised tables. Regarding reports, there will available approved projects, projects in progress, finished projects, management reports (technical, logistic and financial) and papers.
Collaborative learning management.	Coaches assignment for specific period of time, for managers and project team incoming or that require strengthening of knowledge in some of the project processes (initiation, planning, execution, follow up, and control or close up), or as a PMO member. Training programs are in accordance with the evidence of gaps in the application of processes or activities described in the reference framework of projects. Training programs of new topics in the implementation of projects (ex. Execution of agile projects) Training programs on the use and appropriation of collaborative information and communication technologies which facilitate the shearing and transferring of knowledge permanently.

Steps for the Implementation of a PMO

Regarding implementation of a PMO, in general the methodology of the maturity model, (OPM3), it states that it should be progressive, it should start to operate in a simpler and focused manner, mainly to show results rapidly, it should evolve in its attributions and complexity, initiating with a reporting model of results, information consolidation, compilation of experiences, and spreading of culture. The sponsorship from the top management is also fundamental for the implementation of the PMO (Díaz-Piraquive et al., 2019; PMI, 2017).

Following are the necessary steps for the implementation of a PMO in an organization supporting the execution of projects, with the aim of improving the scope delivery, the costs and time optimization, and the success in the development of projects (see Table 12).

The creation, sharing, sharing and transfer of knowledge starting from the development of projects, starts to have an important allied in the PMO. This should start to operate in a simpler way and be focused, mainly to show results rapidly.

The PMOs, are organizational entities defined, with equipment and processes as well as with autonomy in the project's organization. Evidence of cases and literature show that it is important for the success of the implementation of a PMO, that it gets structured in an autonomous entity, permanent or temporary, with a high level of hierarchy in order to assume a more transcendental role and with its objectives Aligned with the strategies of the organization. Another success factor is to count with the sponsorship and direct support from the top management of the organization (PMI, 2017).

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Table 12. Steps for the implementation of a PMO

Mission	Prepare the mission declaration of the PMO. This should reflect the PMO's essence in one or two sentences, containing the purpose of it and the listing of those whom services are intended.
Vision	Prepare the vision declaration of the PMO. It should indicate where the PMO is intended to go at long term, or what it pretends to become. The vision responds to the question: "What does the PMO want to be?"
Goals	Prepare the goals. They consist in high level declarations of benefits that the PMO will try to reach on the next one, two or three years. A higher detail level will be given by the definition of objectives, which refer to a short term, and they are optional being redundant with other definitions.
Objectives	Define the PMO's objectives. They could be defined beginning with the SMART model, which specifies the characteristics that they should meet.
Success Factors	To achieve a successful PMO, there are several key factors which should be considered. Those which cannot fail at all during the project's execution are taken into account.
Barriers for success	Likewise, there are factors which can act as barriers for the implementation of a PMO. Such as, objectives not quite clear, not defined correctly nor communicated, nonexistence of commitment from the high and middle management, and from the PMO. All this is perceived as an expense, among others.
Analysis of interested parties	The first step in the analysis of the interested parties is their identification. Group tools may be used such as brainstorming, including all those who could be affected by the implementation of the PMO, who could have some influence or power over it, those who could have an interest in its success or its failure. etc.
Understand the interested parties	Once the interested parties are identified, it is necessary to understand how they feel, and their possible reaction with respect to the implementation of the PMO, how they should participate in the project, and what is the best way to communicate with them.
Classify the interested parties	This step consists in locating the interested parties in a grid according to their power and interest in the PMO, that allows the summarizing and showing of the collected information about the interested parties, so that they rapidly may comprehend: Who are interested opponents or critics, and Who are interested defenders and project supporters.
Definition of Responsibilities	During the design of the PMO it will be necessary to evaluate a series of key factors which can be the base for the identification of future roles or responsibilities. Factors to be taken into account: Organizational factors, (who would the PMO report to), position in the organizational structure, projects under scope, ownership of resources, PMO permanent/temporary, size and budget), Human Resources (recruiting and selection, training and certification, evaluation and promotion, provision of resources to projects, scheduled control of resources, career planning, personnel management, external suppliers management, counseling and mentoring), Project Management, (establishing of methodologies for project management, provision of templates, project management tool review, provision of document repositories). Execution of the project, (risks management, change and impact management, communication, projects auditing, focus on big or special projects, follow up and project control). Strategy (collection of initiatives, projects evaluation, priorities of projects, planning and scheduling, projects approval and financing, project portfolio management).
Definition of services	Upon finishing the responsibilities evaluation, a clear scope of the PMO is evident. At this point, we are in conditions to determine and formulate the services that the PMO will render (provision of a documents repository, of projects management tools, assuring quality and management consulting, processes, procedures, formats, templates, among others).
Organization	Define the operating structure, the necessary roles to be covered by the PMO and define the problem escalation relationship. Likewise, it is necessary to define the communication systems.,
Plan for establishing the PMO	An implementation plan of a PMO could be organized in phases or stages: • Phase 1. Definition of scope • Phase 2. Planning • Phase 3. Start of the PMO • Phase 4. Start up and execution of the PMO • Phase 5. Review post-implementation - Continuous improvement It is necessary that each phase groups all activities that should be carried out in it.

Source: Adapted from Delgado et al. (2018), Díaz-Piraquive et al. (2019), PMI (2017) and Randall et al. (2003).

The internal structure of the PMO depends on its own attributions. The team must have a strong focus in project management and should be made up by experts on the several areas of knowledge. Total leadership of the person managing the PMO is important

Unfortunately, the implementation of a PMO is focused on functions, and neglects the cultural change, necessary in the organization for its acceptance. Since any change in the processes of an organization, brings associated problems, it is very important to create a sense of need and substantiate the value that will be provided. Responsible staff for this task and future members of same, will need to think and act as change agents. Additionally, the sponsorship from people who will help to define and implement the necessary changes will be required. It is important that this people occupy a position of power, and that they be developed as a work team.

A good way of starting this initiative, is through an evaluation of the actual status of the organization, with respect to the GP, the development of a vision of future, and lately, a general analysis. These initial evaluations will give a general idea of work required to be done.

Gradually, its attributions may go being sophisticated, as they go gaining confidence in the team. The issue of sponsorship from the top management, also has a fundamental role in the implementation of the PMO, and it guarantees a collaborative learning environment, sponsored by themselves.

One of the most important aspects to consider for an optimum management of a PMO, is the facilitation of the government committee, since the manager office must establish the order of work in all the portfolio, and although the PMO generally does not take care of the priority of projects, it is responsible to help the manager's office in the definition of the process and its exercise. Likewise, the PMO supports the top management in their decisions to assure that the strategic objectives are reached, that a balance exists between the commercial part and production, and that the government committee gathers on a regular basis and takes decisions as required, be registered and formally communicated.

Regarding priorities of the project's portfolio, it should be established by the government committee, based on the contribution of each project for goals and the business performance. The PMO should ensure that projects continue with that contribution, and they should communicate about it to the committee, keeping priorities of projects through the organization.

The PMO should manage the marketing and communication processes, since the project team should feel the motivation to use the services, finding that this office has lots of value regarding continuous improvement in the execution and control of projects. The PMO must be communicated on a regular basis, and very significantly with their customers, since they should not reject the power and the importance of the simple communication face to face, well planned as a strategy for the project team to promote collaborative work and the practical improvements.

On the other hand, the decisions on model, size and attributions of the PMO, should consider the critical factors of success and failure. A PMO, to be successful, should work as a catalyst, establishing internal links and transforming the scattered information into an organizational knowledge. The office should come to facilitate actions of the project managers, and not to make them more complex. In this sense, it should be guardian of methodology, but not a slave of it, avoiding the role of a simple auditor, becoming the facilitating office for better practices and manager of the utilization of facilitating tools to create, share and transfer knowledge.

The biggest benefit upon implanting a PMO, is to make things easier. To manage projects is a complex task and it definitely fits for the PMO, through automation of tasks, the use of models, of an adequate use of methodology, to create a positive atmosphere, support the project managers and motivate the collaborative learning. From this environment on, the realization of successful projects is possible.

PMOs have a positive impact on knowledge management with organizations; a better knowledge management facilitates project performance (Rincón-González & Díaz-Piraquive, 2019), PMOs facilitate the performance of projects and improve PM practices within host organizations (Rincón-González (2014), Rincón-González (2016), Rincón-González (2017a), Rincón-González (2017b), Rincón-González (2018a) and Rincón-González (2018b)).

SOLUTIONS AND RECOMMENDATIONS

A gathering information instrument with 14 variables of analysis was developed in order to collect data about the management of knowledge in organizations. Variables were defined around the widely accepted knowledge areas of project management (integration, scope, time, cost, quality, resources, communications, risks, procurement and stakeholders) to capture information about how organizations generate, collect, store, share, improve and manage knowledge.

The instrument was applied on a nation-wide fieldwork with a sample of 502 organizations that conduct projects in the Colombian enterprise context. Two groups were identified, organizations with no PMO within its structure (66%), and those that hosted an office to manage its projects (34%).

A detailed statistical analysis was conducted in order to identify the impact of the project management offices on knowledge management within the objects of study. In all the variables analyzed, a significantly higher score was found in those organizations with a PMO, in contrast with those lacking this type of structures.

A set of Two Sample t-tests were conducted in all of the variables of analysis, in order to numerically determine the difference about the management of knowledge when conducting projects between the two groups (organizations with and without a PMO). The t-tests were set with a 95 percent confidence interval and a maximum error of 5 percent (table 13).

For all of the 14 variables of study, the p-value were significantly lower than 0.05 and means of the group of organizations that host a PMO are in all cases significantly higher in comparison with the subjects of study that lack of this type of structures. This allows to statistically infer that, PMOs positively impact knowledge management in organizations that conduct projects in the Colombian enterprise context (see table 14).

The 14 dimensions involved on this study, were incorporated into a variable factor map Principal Component Analysis (PCA) in order to build up an integrative dimension of the impact of knowledge management in the performance of projects in organizations, it was named KM total. The elements within the new dimension can be seen on figure.

A comparison among the groups with and without a PMO, shows a greater mean in the measurement of knowledge management in the cases where the studied organizations host a Project Management Office, as showed on figure 5.

Finally, a comparison in all the dimensions of study can be seen in figure 6. In all cases, the organizations that incorporate a PMO within its structure, aim better scores in contrast of those that lack of this kind of structure. This evidence infers, statistically, that the Project Management Offices have a positive impact on project knowledge and facilitates better results on project performance.

Table 13. Statistical analysis of KM dimensions- Welch Two Sample t-test

Dimensions	Welch Two Sample t-test
KM within scope	> t.test(A5~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: A5 by Z8 t = -5.1143, df = 322.72, p-value = 5.412e-07 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.5311524 -0.2360340 sample estimates: mean in group No PMO mean in group PMO 2.322289 2.705882
KM within time	> t.test(T6~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, data=Dataset) Welch Two Sample t-test data: T6 by Z8 t = -6.027, df = 347.33, p-value = 4.265e-09 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.6130178 -0.3113621 sample estimates: mean in group No PMO mean in group PMO 2.231928 2.694118
KM within cost	> t.test(C4~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: C4 by Z8 t = -4.1128, df = 335.9, p-value = 4.92e-05 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.4917267 -0.1735461 sample estimates: mean in group No PMO mean in group PMO 2.237952 2.570588
KM within quality	> t.test(Q4~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: Q4 by Z8 t = -5.0393, df = 334.59, p-value = 7.663e-07 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.6024511 -0.2641683 sample estimates: mean in group No PMO mean in group PMO 2.084337 2.517647
KM within resources	> t.test(RH4~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: RH4 by Z8 t = -5.3383, df = 318.82, p-value = 1.785e-07 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.6093481 -0.2811551 sample estimates: mean in group No PMO mean in group PMO 2.201807 2.647059
KM within communications	> t.test(CM3~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: CM3 by Z8 t = -5.8046, df = 353.98, p-value = 1.435e-08 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.6118136 -0.3021481 sample estimates: mean in group No PMO mean in group PMO 2.078313 2.535294

continued on following page

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Table 13. Continued

Dimensions	Welch Two Sample t-test
KM within risks	> t.test(R3~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: R3 by Z8 t = -6.0361, df = 309.65, p-value = 4.509e-09 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.6785429 -0.3449157 sample estimates: mean in group No PMO mean in group PMO 1.876506 2.388235
KM within procurement	> t.test(P8~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: P8 by Z8 t = -5.5611, df = 335.34, p-value = 5.482e-08 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.6606446 -0.3154007 sample estimates: mean in group No PMO mean in group PMO 2.259036 2.747059
KM within stakeholders	> t.test(SH4~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: SH4 by Z8 t = -6.3433, df = 346.81, p-value = 7.022e-10 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.6012748 -0.3166557 sample estimates: mean in group No PMO mean in group PMO 1.993976 2.452941
KM within integration	> t.test(I2~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: I2 by Z8 t = -8.9535, df = 318.26, p-value < 2.2e-16 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.8552015 -0.5470664 sample estimates: mean in group No PMO mean in group PMO 1.951807 2.652941
PM knowledge	> t.test(O7~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: O7 by Z8 t = -9.8431, df = 291.23, p-value < 2.2e-16 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -1.0013343 -0.6676239 sample estimates: mean in group No PMO mean in group PMO 1.659639 2.494118
Career path	> t.test(O8~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: O8 by Z8 t = -7.8823, df = 291.94, p-value = 6.433e-14 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.8400196 -0.5043461 sample estimates: mean in group No PMO mean in group PMO 1.557229 2.229412

continued on following page

Table 13. Continued

Dimensions	Welch Two Sample t-test
Lessons learned	<pre>> t.test(O9~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: O9 by Z8 t = -6.192, df = 315.91, p-value = 1.846e-09 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.7365291 -0.3813306 sample estimates: mean in group No PMO mean in group PMO 1.870482 2.429412</pre>
KM tools	<pre>> t.test(O10~Z8, alternative='two.sided', conf.level=.95, var.equal=FALSE, + data=Dataset) Welch Two Sample t-test data: O10 by Z8 t = -8.911, df = 280.33, p-value < 2.2e-16 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.9408561 -0.6003912 sample estimates: mean in group No PMO mean in group PMO 1.623494 2.394118</pre>
KM total	<pre>> t.test(KM.Total~Z8, alternative='two.sided', conf.level=.95, + var.equal=FALSE, data=Dataset) Welch Two Sample t-test data: KM.Total. by Z8 t = -10.257, df = 311.32, p-value < 2.2e-16 alternative hypothesis: true difference in means is not equal to 0 95 percent confidence interval: -0.6393370 -0.4335242 sample estimates: mean in group No PMO mean in group PMO 1.996343 2.532773</pre>

Source: Developed by the authors with Statistical Software R ®

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Table 14. Statistical analysis of KM dimensions- Welch Two Sample t-test

Dimensions	p-value	No PMO mean	PMO mean	Difference on level of performance when a PMO exists	Correlation with KM/ impact of KM on dimension
KM within scope	5.412e-07	2.322289	2.705882	High degree of differentiation	Positive / positive
KM within time	4.265e-09	2.231928	2.694118	High degree of differentiation	Positive / positive
KM within cost	4.92e-05	2.237952	2.570588	High degree of differentiation	Positive / positive
KM within quality	7.663e-07	2.084337	2.517647	High degree of differentiation	Positive / positive
KM within resources	1.785e-07	2.201807	2.647059	High degree of differentiation	Positive / positive
KM within communications	1.435e-08	2.078313	2.535294	High degree of differentiation	Positive / positive
KM within risks	4.509e-09	1.876506	2.388235	High degree of differentiation	Positive / positive
KM within procurement	5.482e-08	2.259036	2.747059	High degree of differentiation	Positive / positive
KM within stakeholders	7.022e-10	1.993976	2.452941	High degree of differentiation	Positive / positive
KM within integration	<2.2e-16	1.951807	2.652941	High degree of differentiation	Positive / positive
PM knowledge	< 2.2e-16	1.659639	2.494118	High degree of differentiation	Positive / positive
Career path	6.433e-14	1.557229	2.229412	High degree of differentiation	Positive / positive
Lessons learned	1.846e-09	1.870482	2.429412	High degree of differentiation	Positive / positive
KM tools	< 2.2e-16	1.623494	2.394118	High degree of differentiation	Positive / positive
KM total	< 2.2e-16	1.996343	2.532773	High degree of differentiation	Positive / positive

Source: Developed by the authors with Statistical Software R ®

FUTURE RESEARCH DIRECTIONS

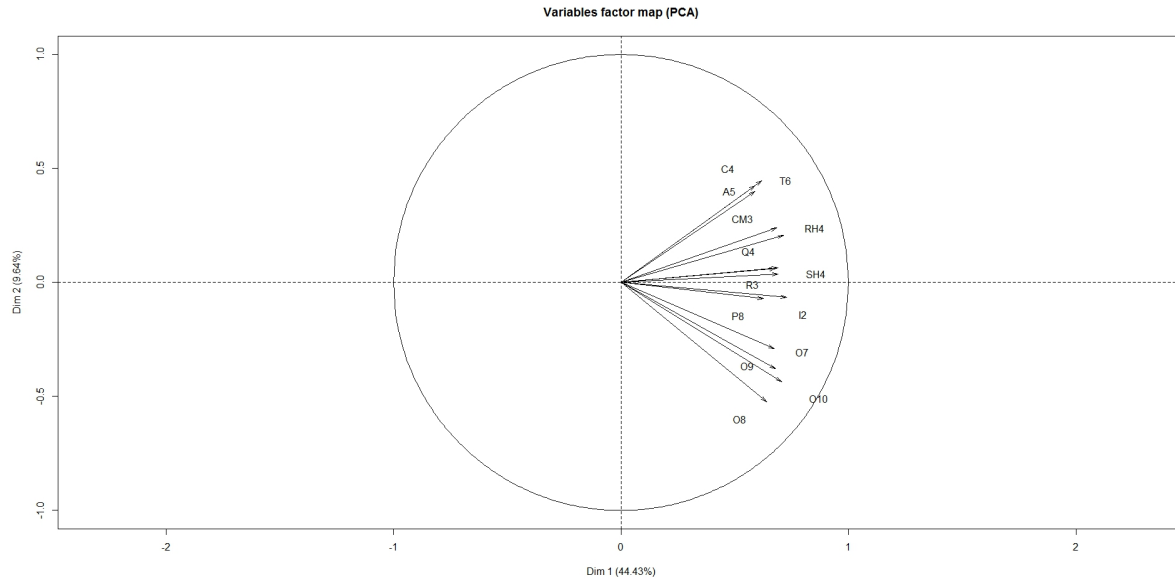
As future lines of research, it was proposed to develop applied studies in order to determinate the impact of knowledge management on project performance and to identify the positive impact of PMOs on other relevant aspects of project management.

CONCLUSION

In conclusion, the theoretical framework identified the main concepts related to the knowledge management and the project management offices, those elements were incorporated into the research. A bibliometric

Figure 4. Variable factor map (PCA) for KM total dimension

Source: Developed by the authors.



analysis about the knowledge management and PMOs showed the most investigated topics, key authors and principal sources with the majority of quotations and documents. As main topics arisen: project management, information management, knowledge based systems, human resource management, investments, project manager, risk management, performance, and success. As key authors emerged: Aubry, M.; Glückler, J.; Müller, R.; Lavoie-Trenblay, M.; Marchionni, C.; Richer, M.; and Cry, G. And finally, as principal sources, with the larger number of articles and citations appeared: Project Management Journal, International Journal of Project Management, and International Journal of Managing Projects in Business. A nation-wide fieldwork, with a sample of 502 organizations that manage projects in the Colombian enterprise context, was conducted. For all of the variables of study, a significantly positive impact of PMOs on knowledge management was identified. This research work demonstrated that the project management offices greatly benefit the generation, collection, storage, sharing, improving and managing of knowledge in Colombia.

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Figure 5. Boxplot of total knowledge management dimension between organizations with and without PMOs

Source: Developed by the authors.

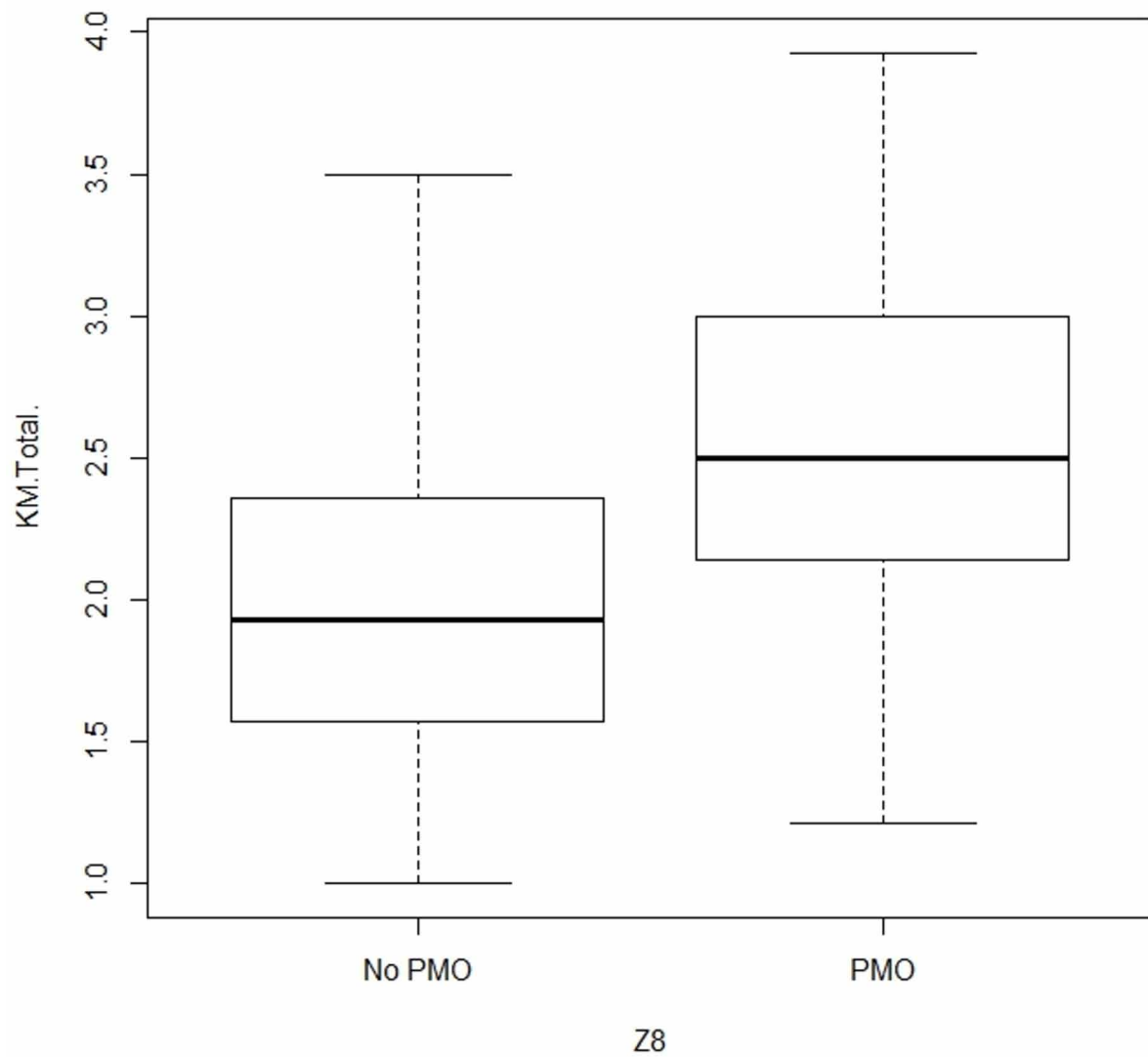
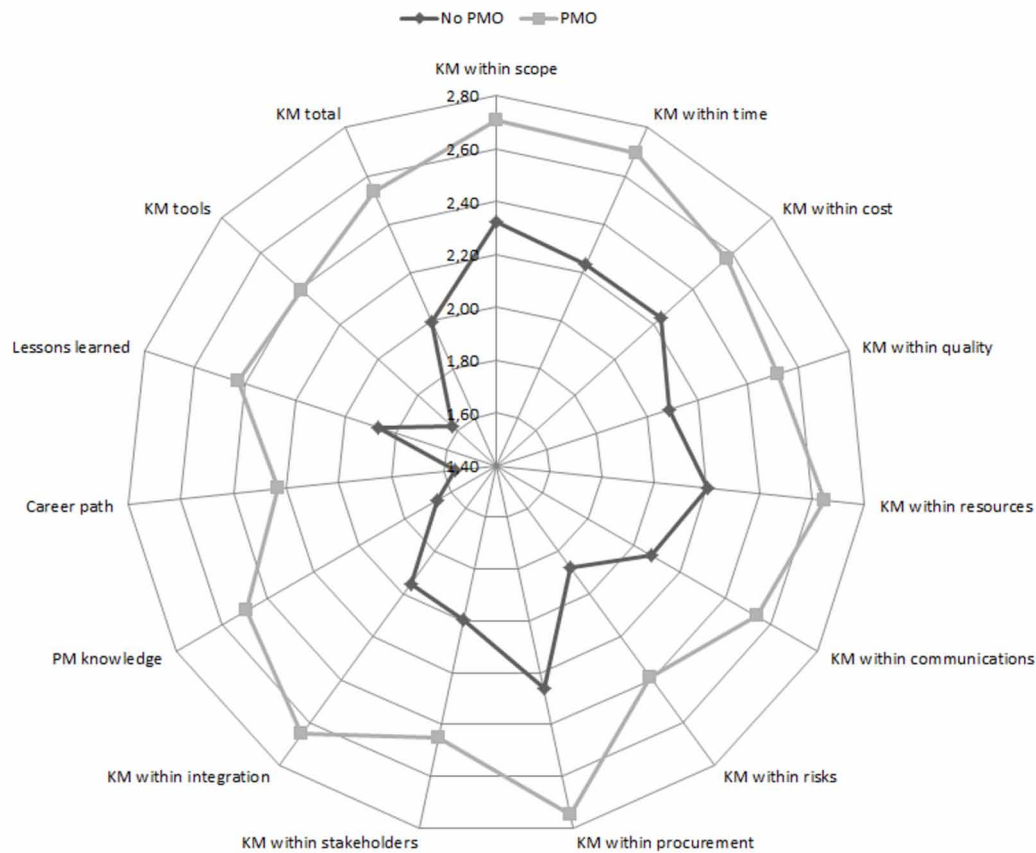


Figure 6. Radial comparison on knowledge management dimensions between organizations with and without PMOs

Source: Developed by the authors.



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KEY TERMS AND DEFINITIONS

Bibliometric: Is the “statistical analysis of books, articles, or other publications” (Oxford, 2018a).

Knowledge: Refers to “facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject” (Oxford, 2018b).

Knowledge Management: “A mixture of experience, values and beliefs, contextual information, intuition, and insight that people use to make sense of new experiences and information [to manage a project properly]” (PMI, 2017, p. 709).

Manage Project Knowledge: Is defined as “the process of using existing knowledge and creating new knowledge to achieve the project’s objectives and contribute to organizational learning” (PMI, 2017, p. 70).

PMO: Project Management Office.

Project Management: Refers to “the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements” (PMI, 2017, p. 10).

Scientometric: Is the “the branch of information science concerned with the application of bibliometrics to the study of the spread of scientific ideas; the bibliometric analysis of science” (Oxford, 2018c).

Chapter 8

Competence Training for Project Management: Holistic Analysis Framework

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ABSTRACT

Organizations currently need project managers that are capable of performing in environments where change has gained great relevance. To accomplish this, these professionals must possess very diverse skills. On the other hand, project management is a young discipline that requires research to help us understand how to develop these skills. This chapter provides a holistic research framework proposal that is based on four elements: competences, approaches, scenarios, and levels of analysis. We affirm the importance of the meta-cognition competency, which is not commonly mentioned in previous studies but has proven to be very useful for a professional development that is self-regulated, reflective, and experience-based, with emphasis on the opportunities offered by new technologies. Two fundamental challenges are introduced: achieving a list of unified competences and transferring individual competences to the project teams and the organizations where these competences are displayed.

INTRODUCTION

The Project Management activity has drastically changed in recent years, primarily because the markets are more competitive than before and they evolve at great speed. Clients are increasingly demanding more for less and public opinion has a relevant role nowadays, which was not present in previous generations. Project deadlines tend to be shortened, requiring they be completed as soon as possible since the start

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of their operations has a very significant economic impact. Likewise, budgets are very tight and both factors may negatively affect the quality, which is something that the market does not allow under any circumstance. Often times the requirements to be met are not clear at the beginning or change throughout the project as a result of constant changes as well as increased uncertainty in the project environment.

On the other hand, digitization has provided new opportunities but has also introduced additional complications. The products to be supplied are technologically more complex since new requirements have been introduced as required by the market. Also, new technologies have emerged such as the Internet of things (IOT), BigData, additive manufacturing, Cloud Manufacturing or the Augmented Reality and Virtual Reality (AR&VR), among others, which are affecting the requirements of products as well as the manner in which the projects are managed to achieve them. One of the main characteristics of the industry 4.0 is the high degree of automation of the processes. Applying this way of working will undoubtedly affect the managing of projects, especially the control processes where most of the information must be digitized, replacing paper with digital resources managed through specific applications or control software.

Communication within a project currently has nothing to do with how we communicated just ten years ago. The project team has multiple tools and devices available and also has a large amount of data, from which they must select the most relevant for making their decisions. Somehow, the size of the projects has increased and not only due to the existence of increasingly more ambitious mega-projects. In general, all projects have more variables, more interconnected elements, more legal provisions to comply with, etc. A characteristic that increases the complexity of managing the communications is the internationalization of the projects and the fact that part of the team is located offshore.

Therefore, project managers must adopt new roles, which must be defined each day. The same holds true for their training, which is often based on unconscious assumptions based on old ideas (Lonie & Desai, 2015). We must also not forget that students have also changed and have their own expectations and motivations, which must be taken into account.

The challenge entailed by training our current professionals is shared by most of the disciplines. Encouraging progress has been made in many related professional fields that are worth noting. The objective of this chapter is to identify a working framework that arranges the studies on competences training of project managers as well as propose lines of work in terms of the current challenges and trends.

The methodology that is followed is a combination of bibliographic review and discussion. Initially, on the one hand, we search for research published in terms of training by competences in the project management discipline. Additionally, we will also consult the models on the competencies of project management, which have been drafted by the two most important project management associations: PMI (Project Management Institute) and IPMA (International Project Management Association). On the other hand, we have searched for recent review type publications on training adults for pursuing a profession. A wide perspective was sought, not only in the adopted approach but also in the disciplines that were being reported. In particular, we collected publications on the education of adults, on management and health sciences. In a subsequent phase, the sources consulted were extended following the snowball tactic.

Although many of the issues are common to any phase of the project management training process, this chapter has focused primarily on some of the aspects related with the post-university stage. The chapter is structured as follows: The next section introduces the holistic analysis framework proposal for project manager competences training. A review of the competences training, its benefits and limitations is provided below, introducing the most significant experiences in this area. This will be followed by a review of different approaches that have been of interest in recent years and which could be considered

for training project managers. Then, some challenges will be discussed in terms of training as well as current and future competences. Finally, future developments, conclusions and relevant bibliography will be identified.

HOLISTIC ANALYSIS FRAMEWORK

Figure 1 provides a graphic summary of the proposed holistic analysis framework for study and research in terms of project management competences training. The framework is comprised of four fundamental elements: the competences to be achieved, the learning approaches, the training scenarios and the levels of analysis.

First and foremost, we must collect the list of competences that must be possessed by the project manager. The following section of this chapter lists some of the specific competences defined by academics and professional associations for this position. As we will see, one of the greatest challenges we must face at this point is that a single and common list is not available of the specific competences of the project manager, nor is there a generally accepted classification or hierarchical order for these competences. In the references that have been compiled, it is normal to find very specific competences intermixed with others that are more of a general nature called meta-competences (what Nijhuis et al. (2018) called “container” competences). It is worth highlighting that we have even detected that competences identified by different sources as key competences have not been assigned the same meaning or attributed the same characteristics.

The second element of the holistic analysis framework covers the approach that is to be adopted in studying the training process, which is conditioned by the selection of the theory that is to be applied. Historically, many theories have been developed in terms of teaching and learning, which could be grouped into four perspectives: behavioral, cognitive, constructivist and social cognitive (Woolfolk, 2019). Within each one of these perspectives, there are variations and overlaps, especially between the constructivist perspectives. In the project management area, the cognitive-social approach is the most commonly used because it is understood that the body of knowledge is constantly changing and built through the interaction with others and the environment. In any case, none of the previous perspectives is capable of answering all the questions (Woolfolk, 2019). Also, they should be supplemented with other theories that are not specifically derived from learning such as those related with motivation and emotions, among others.

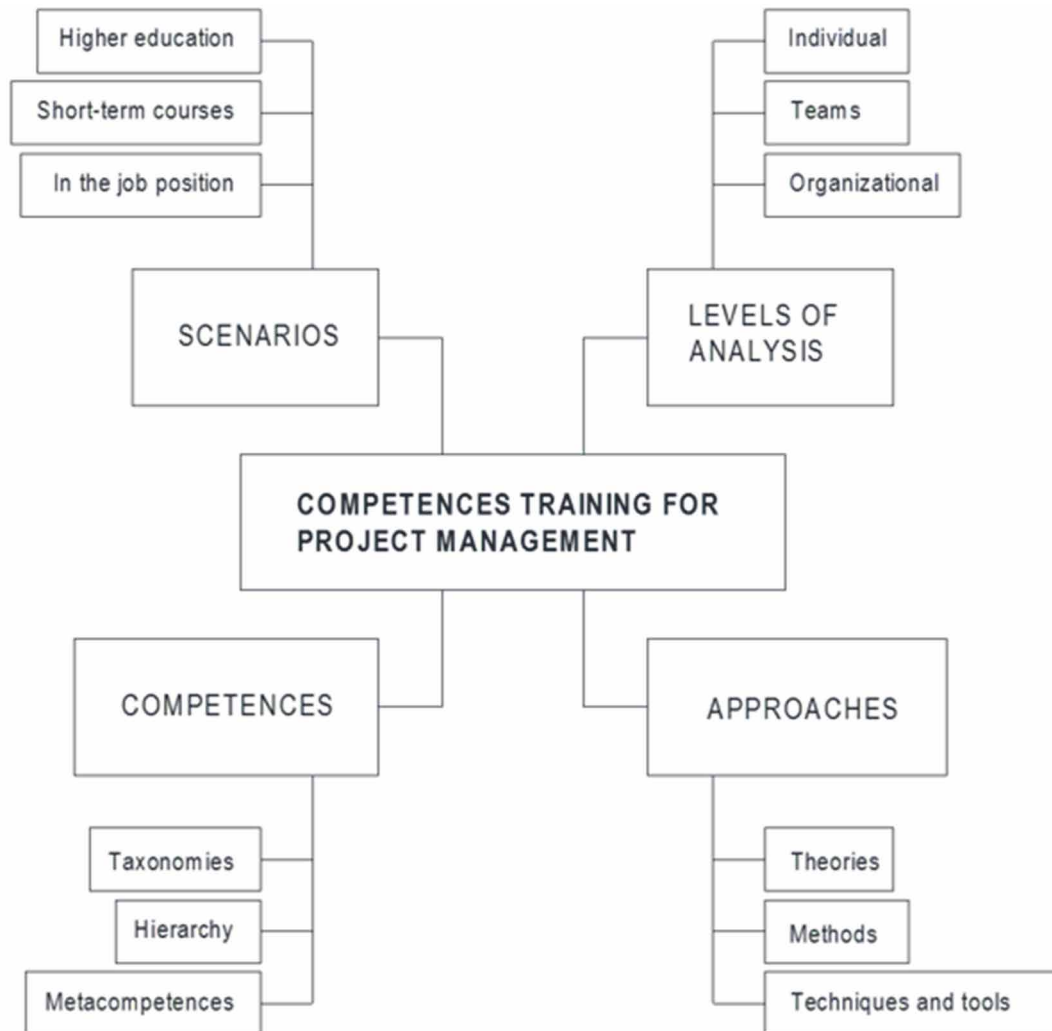
Any study related with teaching and learning must start with the theoretical basis of reference to subsequently choose the specific methods, techniques and tools, in terms of the players, the environment and the specific objectives to be achieved.

Given the great scattering and number of theories on learning, techniques and tools that are currently mentioned in the literature, a comprehensive compiling of these is beyond the scope of this chapter. Without excluding any of the existing theories, techniques or tools, we have sought specific aspects considered of reference, interest and application in the process of training the project management professional.

The third aspect of the holistic framework has been called training scenarios. It is worth highlighting that the professional profile of the project managers is changing. Traditionally, the manager was a person with engineering or similar type training, who had certain management skills, wanted a change in career or had been promoted and was now carrying out project management functions. This process still

Figure 1. Finding a holistic framework to study project manager competences training

Source: Prepared by the authors



INTERRELATIONSHIPS AND TRENDS

occurs; however, young professionals who are specifically being trained in project management, either through post-graduate or undergraduate courses, are increasingly being appointed to these positions.

Therefore, on the one hand, we have the university coursework completed by students with a profile lacking practical experience and on the other hand, the postgraduate coursework, which is completed by personnel with a more diverse professional profile, of different ages and with different experiences. Additionally, single-subject specialization or knowledge refresher courses that have a shorter duration. Finally, we have training in the job position itself, which must be scheduled, monitored and evaluated just like in the cases mentioned above.

The fourth and final element refers to the different levels of analysis. Traditionally, the project manager competence models have generally been focused on the project manager's role. However, the project manager manages one or several project teams inside an organization. The competences of a group or an organization are not determined by merely adding the competences of the individual personnel that comprise the group. Also, the role of an organization, through its human resources policy, in training its project managers is notable since it may encourage the professional development of project managers in different ways; like for example, by encouraging senior personnel to engage in coaching the younger employees.

TAXONOMIES OF THE PROJECT MANAGER'S COMPETENCES

There are different ways of classifying the project manager's key competences. The choosing of one or another form of organizing these competences greatly affects their defining and even their selection.

On the one hand, professional associations have submitted their particular proposal. PMI has defined a competences development framework aimed at the project manager (PMI 2017) based on the PMI talent triangle, which main pillars are technical knowledge about portfolio/program/project management, leadership in portfolio/program/project management and specific competences of the business, which in turn are defined by organizational and specific aspects of the economic sector, among others.

Three types of competences have been defined:

- **Knowledge:** Specific knowledge about project management related directly with the areas of knowledge defined by its standard (PMBOK, 6th Ed) which the project director must possess. This requirement is usually satisfied by providing different types of proof such as diplomas and also through the project manager's experience, which may be directly related or relevant to a specific area or sector.
- **Performance:** What the project manager is capable of doing or accomplish by applying project management knowledge. This refers to the individual performance in completing the project's tasks and is focused on project results grouped in five units: initiating, planning, executing, monitoring and controlling and closing the project.
- **Personal Competences:** Personality characteristics that support the ability of a person to complete a project. It refers to behavior, motivation, attitudes and self-concept that allow a person to successfully manage the project. These are grouped in six types: communicating, leading, managing, cognitive skills, effectiveness and professionalism.

The competences are the objective of the competences development plan, key to PMI, which determines the activities that must be carried out by the project manager to learn the required skills, once the evaluation is conducted to determine the competences to be acquired or improved. Table 1 provides a list of the exposed competences.

On the other hand, IMPA has historically conducted great work on competences. In fact, its project management model is based on the professional competences of the project manager. IPMA defines competence as the application of knowledge, skills and abilities to achieve the required results (IPMA, 2015). Knowledge is the information and experience a person possesses. Skill refers to the ability that

Table 1. PMCD framework. Source: PMI (2017)

Knowledge / performance	Project integration management
	Project scope management
	Project time management
	Project cost management
	Project quality management
	Project human resources management
	Project communications management
	Project risk management
	Project procurement management
	Project stakeholders management
Personal	Communicating
	Leading
	Managing
	Cognitive ability
	Effectiveness
	Professionalism

allows a person to carry out a specific task. Ability is the effective application of knowledge and capacities in a specific context.

The competences have been divided into three areas:

- **Perspective:** Refers to the methods, tools and techniques through which personnel interact with the environment as well as the logic that guides personnel, organizations and societies to begin and support projects, programs and portfolios.
- **People:** Refers to the personal and interpersonal competences required for participating in or successfully leading a project, program or portfolio.
- **Practice:** These are the specific methods, tools and techniques used in projects, programs and portfolios to achieve their success.

IPMA also anticipates developing competences throughout the professional career and considers it has three levels: individual, team and organizational, describing these competences in terms of project, program or portfolio management. Table 2 lists the competences defined by IPMA in its Individual Competence Baseline (IPMA, 2015).

An important aspect to consider is that IPMA defines a higher level of competences in its Organizational Competence in managing projects standard (IPMA, 2016) which is responsible for the organization's role in managing the projects and how this role can contribute to the achieving of the company's strategic goals.

Within the five defined competence groups (governance & management systems, organizational structure, processes, culture, people & team and other resources) it is worth highlighting that a very important aspect to achieve success in the projects does not only depend on the individual competences

Table 2. IPMA competence baseline

Perspective	Strategy
	Governance, structures, and processes
	Compliance, standards, and regulations
	Power and interest
	Culture and values
People	Self-reflection & self-management
	Personal integrity & reliability
	Personal communication
	Relationships and engagement
	Leadership
	Teamwork
	Conflict & crisis
	Resourcefulness
	Negotiation
	Results orientation
Practice	Design
	Goals, objectives, and benefits
	Scope
	Time
	Organization and information
	Quality
	Finance
	Resources
	Procurement
	Plan & control
	Risk and opportunity
	Stakeholders
	Change and transformation
	Select and balance

Source: IPMA (2015)

of each member of the project team, instead, we must build competent teams. These teams are not built by adding the individual competences of its members; instead, creating an effective collaboration is required by creating working environments where there is a good communication.

Based on this concept, Rezvani et al. (2018) checked the relationship between the emotional intelligence of the team and their performance in the project, suggesting that the organizations should increase the Emotional Intelligence of the team by providing training to each of its members. Emotional Intelligence emerged as one of the fundamental primary competences that must be taken into account when contracting resources for the projects.

Competence Training for Project Management

Different authors have conducted studies or bibliographic reviews, from which taxonomic proposals have been derived. Ballesteros-Sánchez et al. (2017) carried out an extensive bibliographic review of the standards and research conducted on the competences of the program manager and reached the conclusion that there are two types of competences:

- **Hard skills:** technical and knowledge competences that comprise the use of project management methods and techniques.
- **Soft skills:** behavioral and interpersonal competences for managing projects.

In addition to proposing an index for measuring soft competences for project management, the aforementioned authors did not find a correlation between the hard and soft competences, from which it is derived that they need to be worked in parallel. Entities are increasingly implementing an organization based on projects and therefore, these types of competences are more relevant.

One of the latest contributions to taxonomy and the importance of the competences of the project manager is that of Nijhuis et al. (2018). In their search for a taxonomy that is significant and without any ambiguity to project management, they adapted one from Simonet & Tett (2013), applicable to management. Therefore, and after an extensive bibliographic search for competences, they proposed 64 competences, which were classified into 11 groups:

1. Traditional Functions
2. Task Orientation
3. Person Orientation
4. Dependability
5. Open Mindedness
6. Emotional Control
7. Communication
8. Developing Self and Others
9. Information Management
10. Job Knowledge
11. Occupational Acumen and Concerns.

Additionally, they established the importance of each one of the categories through professional discussion groups that were expressly asked to identify the competences that differentiated a project manager from a member of the project team. The 16 most important competences in this study are listed in table 3.

As we can see, these new classifications include new competences that are required for the way we currently manage projects and which did not exist in the competence frameworks related with project management in prior decades. In the next section we describe some of the contributions related with the competences and which are considered of particular interest after a review was conducted of the bibliography.

Table 3. Robust important competences

Domains	Traditional Functions	Communication	Task Orientation	Person Orientation	Dependability
Key competences	Leading	Listening skills	Initiative	Customer focus	Trustworthiness
	Decision making	Oral communication	Decisiveness		
	Monitoring	Written communication			
	Problem solving	Conducting meetings			
	Team building				
	Goal setting				
	Decision delegation				
	Expectation management				

Source: Nijhuis et al. (2018)

EMERGENT COMPETENCES OF THE PROJECT MANAGER

In recent decades, the developing of competences has been the basis for designing graduate and post graduate curricula as well as for permanent training during the professional life (Humphreys et al., 2018). Several researches have been conducted, which were aimed at identifying the competences that must be possessed by a project manager to properly carry out their work; however, an agreed upon list or a single taxonomy of these competences has not been created.

Since the 80s, several authors have analyzed the new project managers' requirements (Svejvig & Andersen, 2015). We can verify that changes in the requirements faced by project managers are increasingly occurring more often. For example, Cicmil et al. (2006) identified the need to create new knowledge caused by the emergent areas in project management based on past experience, social interaction and the relationships between agents and the structure of the project in terms of the context of the project. This new knowledge is generally based on learning based on experience; and during its study, different levels of competences were identified in terms of the years of experience as a project manager. Five levels were defined:

- **Beginner:** faces a problem or task for the first time. Their training is based on learning working rules and procedures.
- **Advanced beginner:** once they have already gained some experience and they begin recognizing and learning based on their past experience.
- **Competent performer:** the learning occurs based on their own experience and that of others and they acquire the ability to reflect and decide assuming risks.
- **Proficient performer:** capable of making decisions intuitively and not fully based on analytical analysis of the situations.
- **Expert or Virtuoso:** encourages critical thinking for themselves as well as for the group, simultaneously obtaining an intuitive and rational decision making at the same time.

However, one aspect to consider, as indicated by Chen et al. (2019), is that the skills that a project manager needs vary throughout his career, depending on the type of functions developed. It should be noted that initially technical skills and the IT skills are of greater importance, but later on, risk management knowledge and the financial and commercial knowledge become more important. In the same vein, Floris and Cuganesan (2019) affirm that project managers with great experience develop different capacities that allow them to dialogue, guide applying their knowledge to align the stakeholders with the success of the project. Nevertheless, this does not imply acquiring new capabilities, but a new way of addressing the project challenges and complexity by applying new perspectives.

To the competences that had traditionally been defined as necessary or fundamental in project management, another series of competences that are generally related with the great change in the project environment have been added to them. The necessary changes both in organizations and in the processes that are carried out in them to adapt to digitalization and industry 4.0 are going to be disruptively including project management and its managers, that will need new skills to cope with the new conditions of the work environment and its tools.

The processes in this new work environment will be highly digitized and a huge amount of information should be managed to help the project manager both in decision making and in the way of communicating and managing the stakeholders' expectations. These environments will be highly uncertain and therefore the flexibility and the capacity to adapt to change arise again as key competencies for the project manager.

These changes will not only lead to new skills, but also to new ways to implement them. Leadership is one of the most analyzed competencies in the bibliography (Santos et al., 2017; Schuh et al., 2014; Bauer et al., 2015; Hecklau et al., 2016), and will lead to the management of decentralized teams with greater autonomy, responsibility and multiculturalism, which will imply major changes in the way in which the project director achieves the efficiency of the team.

The new environment conditions will also be characterized, during their implementation, by the appearance of conflicts and crises between workers, clients and suppliers. The management of these conflicts will be key to the success of the project, so it will be necessary for the new project manager to be able to communicate effectively and adequately and monitor the evolution of the project's work in real time. The project manager of the future will have to be able to use collaborative work software and work with transparency both in decision making and in communicating results to solve the problems that arise in the work teams and along the chain of value (Schuh et al., 2014; Erol et al., 2016; Hecklau et al., 2016).

The results orientation is another of the competencies that the project manager will need to be able to face the challenge that industry 4.0 poses in terms of customization since he/she must be able to align the project objectives with those of its client (Kans & Ingwald, 2016; Kölscha et al., 2017).

Projects are currently immersed in environments that are unknown by the market and clients as well as by the new emerging technologies and the new decision-making methods and tools. Faced with this complexity and ever changing environment, Zhou (2012), Bauer et al. (2015), Erol et al. (2016), and Hecklau et al. (2016) propose creativity as the fundamental competence since it helps to generate new knowledge, find new solutions and technologically innovate to face changing environments in the project. This creativity must be characterized by its purpose since it is not an end in itself; instead, it tries to provide a solution to different aspects that could either be related to products, systems or processes. This creativity must be efficient, innovative and as much as possible, applicable to other projects or environments. This is why project managers currently need to develop this competence, which would allow them to devise different solutions in different environments and situations.

A challenge faced by many managers when developing this creativity is, on the one hand, the training received up to this moment based on obeying the learned methods and practices and on the other hand, the efficiency and the error free they should work with in order to achieve the success stipulated for the project.

Rodríguez-Rivero et al. (2018) considered that one of the greatest challenges in terms of current projects is managing projects in an international context, which entails satisfying the expectations of agents with different cultures and perspectives. Analyzing the risks associated with these types of projects, they propose the psychological competences required for facing them, which again raises the ability to adapt as the main characteristic that serves as a connection to other more specific technical ones (time management, defining, negotiation) as well as personal or individual ones (leadership, team building, communication, and trust building).

In 2007, Shenhar and Dvir, as a challenge, proposed adopting an adaptive approach to project management that allows focusing the aim of the project on the company's results. Likewise, Chipulu et al. (2013) concluded that organizations needed project managers with managerial skills that helped manage not only projects in complex environments but which would also allow getting involved in managing the organization by managing the opportunities and threats found in the environment surrounding the project and the organization. An important conclusion of the study is the classification of the importance of the different categories of competences analyzed in terms of the type of industry where the projects are carried out. The greatest differences are detected in the years of experience, professional qualifications and the management risks where the type of sector has a great effect.

A contribution of great interest is that provided by Svejvig and Andersen (2015), who defined 6 categories of the needs that are currently faced by project managers:

- **Contextualization:** Adapting of the definition of the project to the organization's environment and strategy.
- **Social and Political Aspects:** Analysis of social processes that could affect the project.
- **Rethinking Practice:** Proposing of new processes through reflective practice or self-learning based on experience.
- **Complexity and Uncertainty:** Importance of the complexity of the projects and their environment as well as how to manage it.
- **Actuality of Projects:** Current best practices in project management.
- **Broader Conceptualization:** Analysis of new perspectives of management and the success of the project beyond its limits.

The characteristics of the new way of managing project identified by Svejvig and Andersen in their study compared to the traditional way of managing projects focused on controllability, ability to execute and linearity have become learning, multiplicity, complexity, uncertainty and sociability.

Currently almost all the research is focused on the ability to contextualize the project within the organization's strategy, managing the social and behavioral aspects as well as the emotional intelligence that allows more effectively facing complex or uncertain environments. For this reason, a new social learning tool has emerged within the projects and their teams based on an alternative analysis of the projects. In this sense, Rolfe et al. (2017) propose an innovative competence, the wisdom of conversation, which allows questioning the normal and routine ways of acting and thinking when faced with certain situations that occur in the projects searching for different ways of doing things.

In order to face complex environments, project managers handle a large number of disruptive events that require new competences to facilitate handling these successfully (Rahi, 2019). Considering the definition of the resilience concept of other scientific fields, primarily ecology, psychology and social sciences, Rahi (2019) propose a definition based on Holling (1996) related with the resistance against the difficulties and the ability to react quickly and recover when facing these difficulties. He is not the first author to propose it but it is a recent example of the consideration that the emotional health side is beginning to have.

Some of the competences collected in their research associated with this concept in terms of project management are being proactive, flexibility, ability to detect changes, planning of responses and adapting to a new reality. Within all these competences, Rahi (2019) highlights the following:

- **Awareness:** allows understanding the situations and their changes globally, allowing to make the proper decisions.
- **Ability to adapt to new environments:** the objective is to quickly regain the required balance when the change is not very important or to transform its structure when returning to the starting position is not possible.

In line with the foregoing, Fraser & Greenhalgh (2001) proposed the term capability. Capability is more than competence, in those authors' opinion. While competence is what individuals know or are able to do in terms of knowledge, skills and attitude, capability is the extent to which individuals can adapt to change, generate new knowledge, and continue to improve their performance.

The competences and contributions described in this section are only an example among others, which illustrate the maturity of the project management competences training field of study. Figure 2 summarizes some of the main ideas of this chapter. The roof represents change and uncertainty, which is held by meta-competences: emotional competences, resilience, social competences, contextualization, reflection in/off action, creativity, and project management methods and tools. In the base, digital competences support the rest of them, and metacognition supports the learning in/off practice.

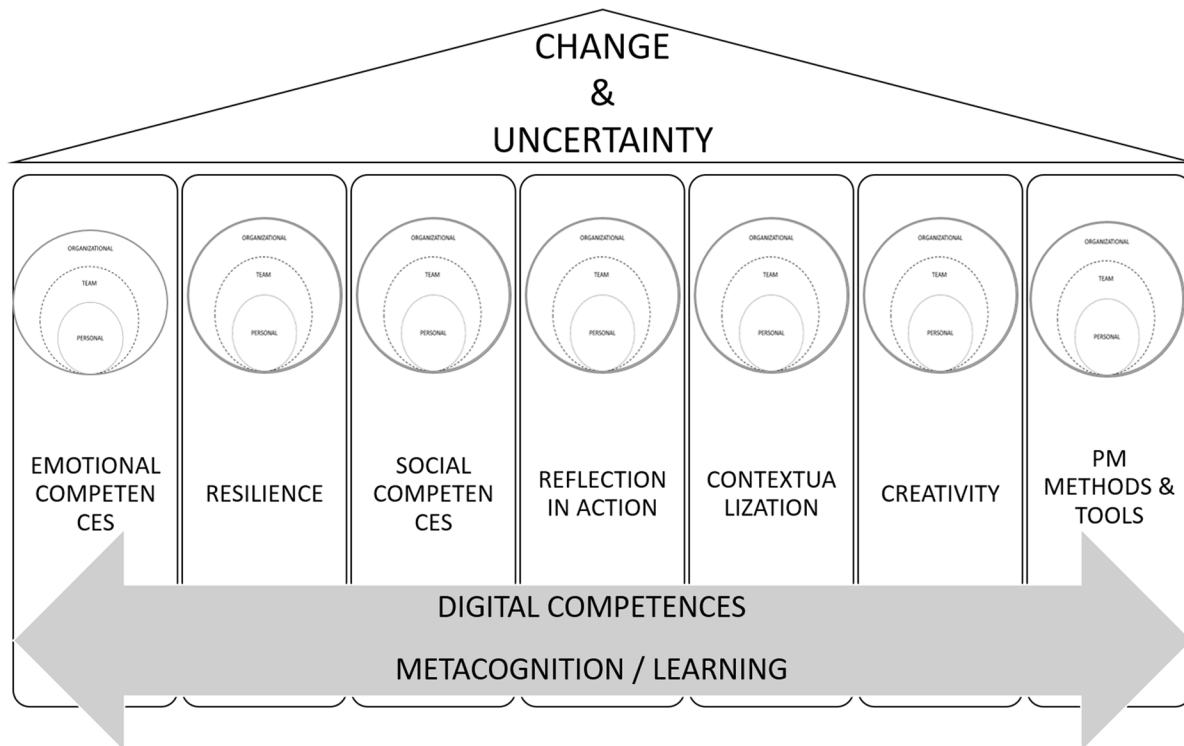
CURRENT APPROACHES TO TRAINING ADULT PROFESSIONALS

The way in which individual competences are combined in the environment of a project group to create group competences or organizations is a question that is raising a lot of interest. On the other hand, it is worth expanding the analysis and collecting the work that is being carried out in other disciplines with common characteristics. The business management area is probably the most related discipline and a large number of magazines are available that are specialized in training the managers at organizations.

However, a particularly active area with respect to competences training is the health area and in particular, the training of doctors, nurses and pharmacists. Even though it may not seem to be related with the project management discipline, similarities may be found that validate the analysis of their experiences in competences training to apply them to project management. Health professionals work with patients. Each patient is unique just like each one of the projects. Treatments that work with some patients do not work with others, as is the case of the different management solutions and the different projects. Also, just like in project management and particularly in the different groups that are involved in a project, there are a multitude of psycho-social factors in the health sector; in the intervention team

Figure 2. Competences graphical framework

Source: Prepared by the authors



itself as well as in the patients, which affect and condition the results. Therefore, it is not strange for the science area of health to be used as a reference beforehand for searching and applying the learning experiences (Ungaretti et al., 2015).

Within the wide range of approaches, we could take into account, we have decided to reduce the analysis to three aspects that have been considered of particular interest in project management. First, the relationship between the level of individual competences of each member of the project team and the level of the same competences in the group have been raised since we have verified in the literature that the adding of individual competences does not always equate to the same level of competences in the team. A similar conclusion can be reached in the case of organizational competences. Secondly, reflective and experiential learning has been considered as a necessary approach in working environment that are highly dependent on the context. Finally, we have compiled some of the possibilities that have been raised thanks to new technologies such as e-learning, social networks, etc.

GROUP COMPETENCES AND ORGANIZATIONAL COMPETENCES

We must clearly differentiate between individual competences and collective competences. Collective competences are not determined by merely adding the individual competences of each member of a group or organization.

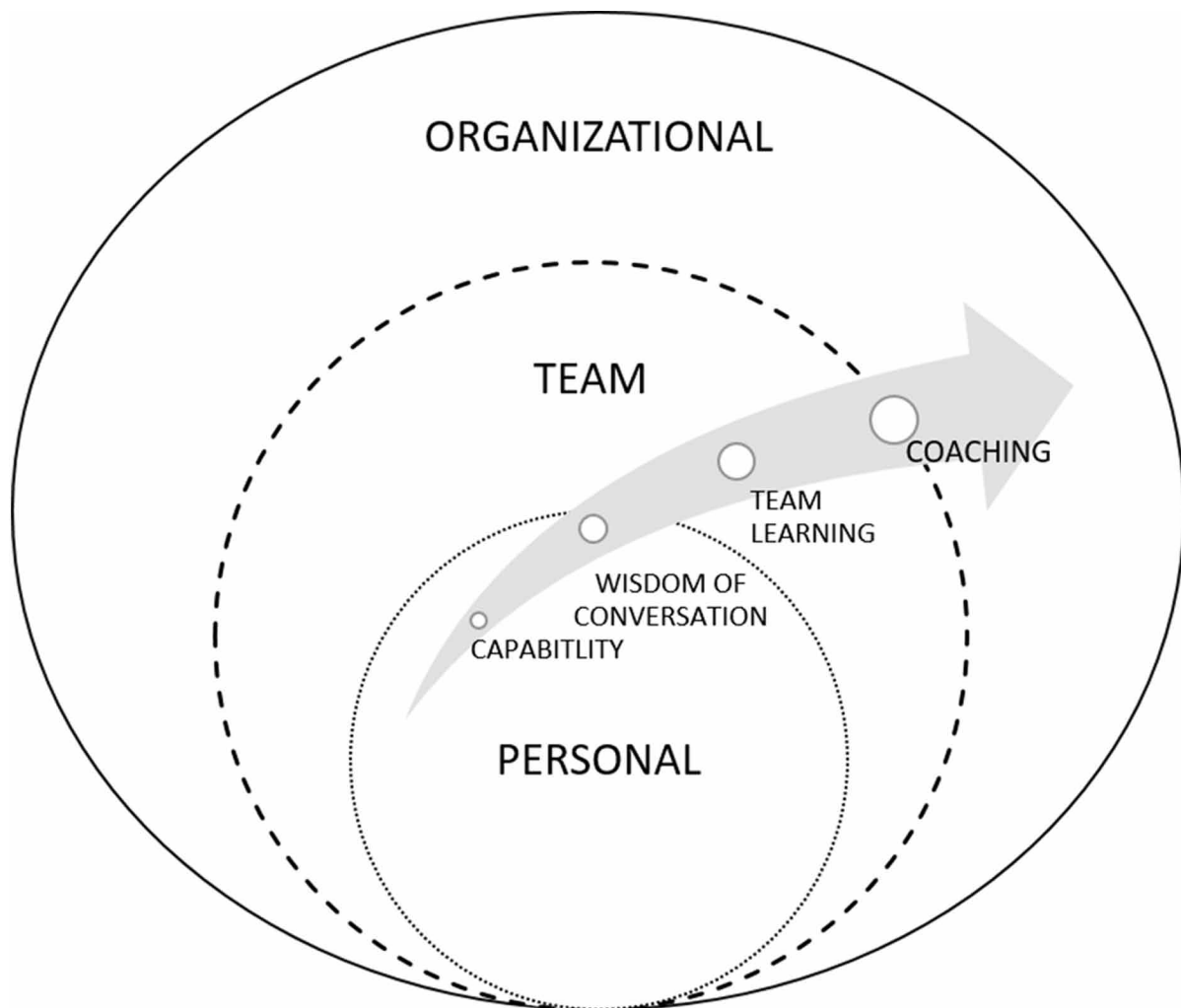
Various concepts have arisen in connection with collective competences. For example, collective knowledge is defined as the knowledge possessed by an organization regarding how to coordinate, share, disseminate and recombine the individual knowledge (Zhao & Anand, 2009). Team cognition refers to the manner in which knowledge important to team functioning is mentally organized, represented, and distributed within the team and allows team members to anticipate and execute actions (Kozlowski & Ilgen, 2006). Finally, team intelligence, which embodies a team's information-processing and responsive capabilities (Huang & Chin, 2018).

Figure 3 illustrates the transition between personal or individual competences and team and organizational competences could be done by applying some of the new training methods.

From this point of view, the so-called T-shaped skills have received a lot of attention in recent years. Personnel with these skills have a profound technical knowledge (vertical axis of the T) as well as a

Figure 3. Field of competences and some training methods

Source: Prepared by the authors



wide range of general skills (horizontal axis of the T), which allows communicating and interacting with personnel from other disciplines (Madhavan & Grover, 1998).

Regarding the organizational competences, one of the main contributions is provided by IPMA's ICB (2015). Based on their extensive experience in competences management, they define the most common ways of developing these according to the individual characteristics of the manager or the organization, on the temporary circumstances and on the availability of the necessary resources for each one of them. These are grouped into the following five categories:

1. Self-development
2. Peer development
3. Education and training
4. Coaching and mentoring
5. Simulation and gaming

It is worth mentioning that currently, some recently applied techniques and approaches have been included in the industry originating from other areas such as psychology (coaching and mentoring) and primary education (gaming).

Taking into account that the development of competences involves interacting with different agents, and their coordination and their effectiveness depends especially on the culture and the organization's environment, it is important to analyze the different agents that take part in this process. The main actors defined by IPMA that may affect an effective development of the competences of managers may be internal, highlighting the department directors (especially in the projects office), HR department and personnel with project management experience; as well as external such as the standards and accreditation centers or external advisors for the company.

If the competences of the groups and organizations have their own identity, it is logical for them to acquire these competences. Therefore, the scientific community has developed a great interest for group learning as well as organizational learning. For example, a sub-discipline that is flourishing in the management area is knowledge management. Also, the main standards of project management are incorporating knowledge management as part of the projects themselves. In fact, it is increasingly more common for organizations to take on internal projects which sole objective is to gain knowledge. Projects and project teams may be conceived as highly generative episodic individual and team learning places that can serve as vehicles or agents to promote organizational learning (Sense, 2011).

In line with the above and from a strictly educational point of view, cooperative learning has emerged and has been added to all educational systems, starting with primary. Students work together and constantly interact to achieve shared learning objectives. But afterwards, during professional practice, organizations turn to cooperative learning within their working groups and also professionals, on their own, seek coworkers, for example, in the so-called training communities, within professional associations or social networks to achieve the training goals they could not achieve on their own.

EXPERIENTIAL, REFLECTIVE AND SELF-REGULATED LEARNING

The duration of the university period is relatively short and some limitations may place the student in similar contexts to those faced in their professions. During university learning, personnel get ready to

carry out the duties of a profession but also continue learning on the job while they are carrying out these duties. Experiential learning or “learning by doing” is a first level method to gain and improve competences but it must not be limited to merely gaining experience, but it must also be a cyclical and deliberate training process. The experiential learning cycle has four phases (Kolb & Kolb, 2009): specific experience, reflective observation, abstract conceptualization and active experimentation. Specific experiences are the basis of observations and reflections. These reflections are assumed and converted into abstract concepts, from which conclusions are derived for the new action. These conclusions may be actively proven and serve as a guide for the new experiences. Experiential learning is present in the PMI competences standard (PMI 2017) and has served as a reference for some studies conducted in the project management area. To mention an example, Cano et al. (2006, 2008) used projects from actual industrial clients, which last year students had to find, and for which they had to find a solution as if they were part of the consulting firm. Other experiences have introduced experiential learning through games or simulation (Saenz & Cano, 2009; Maratou et al., 2016).

On the other hand, most professionals will change jobs several times throughout their life. This, together with the knowledge that is continually emerging and the continuous evolution of the context in which the professional activity is carried out, leads people to not have to continuously depend on an educator and be capable of continuing to learn independently throughout their lifetime. To continue learning on their own in the future, people must be self-regulated beings. Self-regulated learning entails establishing learning objectives as well as the mobilization of resources and the efforts to achieve them. There are three fundamental factors in the self-regulated learning process: knowledge, motivation and willpower (Zimmerman, 1986). To become self-regulated students, personnel must have a good knowledge of themselves as well as of their discipline and the environment where they exercise their abilities. Also, they will be motivated to learn and will put forward a personal effort. This will be a personal process that must be planned, executed, evaluated and self-regulated. The student is an active agent in their training and adjusts their learning through meta-cognitive supervision and control. Very few studies have been conducted on the competences training of project managers and self-regulated learning. Some experiences may be consulted at Lawanto et al. (2013) and Menchaca et al. (2018).

As we have seen, the conscientious reflection of a person regarding their experiences is a central element of experiential learning. In fact, many authors specifically study what they call reflective practice. The reflective practice is based on an in-depth learning based on past experiences. Helps develop critical thinking, resolving problems and the skills required for self-regulated learning and throughout your lifetime since it provides new perspectives and alternatives for future experiences (Tsingos et al., 2014). Schon (1995) integrated reflection and action in two constructs: reflection in action and reflection on action. An essential element of the main standards of project management is the concept of lessons learned, which undoubtedly involve reflection. However, it seems to be more associated with reflection on action without affecting on reflection throughout the professional practice. Rolfe et al. (2017) propose the EHP (Existential Hermeneutic Phenomenology) as an approach for reflecting on the experiences lived by project managers. EHP is a method comprised of different philosophical techniques that allow going from a state of perplexity when faced with a specific situation to an explicit way of questioning your own assumptions and opening the way to considering new possibilities. Its aim is not to question the personal or psychological aspects but on the manner in which a manager understands and tackles his/her projects in practice.

On the other hand, reflection may be shared and enriched; not only with a mentor but also within the work team. For example, van Houten-Schat et al. (2018), in their review of the bibliography related

with self-regulated learning in the clinical context, evidence was found indicating that the support of a coach or mentor seems to be a prerequisite for the self-regulated process to be carried out to its full potential. In project management, Ballesteros-Sanchez et al. (2019) concluded that executive coaching has the greatest impact on behaviors related to leasing, managing, and finding strategies for coping with challenging situations.

From the point of view of the working teams, Harris et al. (2017) proposes an interesting concept that is to be taken into account, which is the deliberate practice as part of a team. Mulec & Roth (2005), on the other hand, talk about team coaching. Coaching refers to helping others to achieve success. This is a learning method where the coach, who may be internal or external to the project's organization, helps the project manager to develop his/her skills. Berg & Karlsen (2007) identified four areas where coaching can be used to help develop: thought, behavior, learning and emotions.

Mulec and Roth (2005) describe the use of team coaching to support reflection and learning in R&D project teams. They found that coaching has a positive effect on the performance of the team, from an efficiency point of view as well as from a creativity perspective and the climate. Finally, the leading role that organizations may play in the process and the organizational culture in particular are worth highlighting (Thompson & Cox, 2017).

LEARNING IN THE DIGITAL AGE

The access and use of all types of digital devices and technologies have changed the lives of people of all ages. Logically, technology is also used in learning; in the classroom as well as at the workplace and at home. Successful experiences are increasingly taking place regarding analyzing the effectiveness of competences training (soft as well as hard) based on electronic media, especially the entire ICT development sector (Steshenko et al., 2017; Motsching & Güver, 2017).

Naturally, current generations of university students accept the new training scenarios based on digital technology. Several applications are used (Google apps / Graasp) in their personal training curriculum, including the social footprint of each one of them as something positive in their training (Rejon-Guadia et al., 2019; Bogdanov et al., 2012). The new student profile is a factor that greatly affects how higher training is practiced. The way new students wish to be trained is very different than that of previous generations.

Support tools such as virtual classrooms have proliferated, which are used to supply information, videos, communicate with the student, turn in work and even take exams. For teaching and learning, these virtual classrooms constitute a platform that provides flexibility and promotes collaboration between students and with the teaching staff (Ashleigh et al., 2012). Video conference or similar equipment allows holding courses in real time where teachers and students can be located in different geographical locations far away from each other.

Technology also plays an important role during student practical or professional training periods. For example, a good part of the tools used to facilitate the reflective practice that Tsingos et al. (2014) found in their bibliographic review have a digital format: magazines, diaries, e-portfolios, blogs, reflection tests, self-evaluations, evaluations in pairs, etc.

Distance learning is an ideal resource for many adults that require combining work and training. The introduction of new technologies has resulted in a first class qualitative and quantitative leap, developing into what we know as e-Learning. Logically, research in e-Learning has experienced an important

increase in recent years. One of the fundamental problems of online courses is that it is difficult to keep the attention of students focused for a long time (Davis et al., 2018; Panigrahi et al., 2018); among other aspects because users are isolated and tend to adopt a passive role. Noesgaard and Ørngreen (2015) compiled a bibliographic review of the factors that influence the effectiveness of this type of learning, finding there are three types: the context in which the e-Learning solution is used, the artifact (the solution itself) and the individual persons that use it. Davis et al. (2018) identified three important strategies to achieve active and effective learning using this type of resource: cooperative learning, games and simulations and interactive multimedia. Panigrahi et al. (2018) also defended cooperative learning and proposed integrating online learning with virtual communities to encourage student involvement and obtain better learning results.

Games and simulation are relevant resources for educating any professional during their time at the university as well as afterwards. Vlachopoulos and Makri (2017), during their bibliographic review found that games and/or simulations have a positive effect in achieving the higher education learning objectives. They identified three types of results when they added games to the learning process: cognitive, behavioral and affective. The project management field has an insufficient number of simulation applications (Rokooei et al., 2017). In any case, successful experiences have been documented such as that of Dzeng and Wang (2017), to work the negotiation competence in construction projects, that of Castronovo et al. (2017) for the problem resolution competence or that of Rumeser and Emsley (2019), in the decision making competence with different levels of complexity, to mention a few examples.

From an experiential point of view, social networks are a front-line tool. In this context, we have verified how social networks are one of the best training systems in projects or organizations that are geographically dispersed, especially for transferring knowledge. Systems based on wikis are worth mentioning, which allow collaborating in project daily tasks such as learning the best practices of other coworkers in the same areas since they are the digital conversion of the traditional face to face work (Breuning, 2016; Aramo-Immonen et al., 2016). Another interesting application of the communities created on social networks is in the analysis of its data for designing the working environments of a physical meeting that occurred as a consequence of one of these communities or even for promoting the pre and post meeting interest.

Another platform used by social networks identified as key for sharing information and knowledge is Twitter (Mills et al., 2018). The characteristics that allow true knowledge networks to emerge on Twitter are its speed and the ability to combine different subjects via their hashtags. It is worth highlighting that this is an appropriate social network for actively searching for (in)formation that allows creating a space where researchers can interact.

Social networks called community of practice are of great interest in the project sector. These emerge to share the particular experience of each one. Personnel that integrate these social networks share the same profession but not the project or organization and find it useful to learn from and with colleagues in their career field. Knowledge is generated in that interaction and advisory process for resolving problems (Smith et al., 2017). While even though these types of groups could exist prior to the emergence of the digital era, it is today when the interaction among all the components is continuous in time and not sporadic as it traditionally has been. In the project management area, Hysa and Spalek (2019) researched the opportunities and threats that social networks provided for project managers, finding that, among other things, supported the management of knowledge and the professional development of the employees. Rosa et al. (2016), on their part, introduce a social network model that supports managing the lessons learned in projects. Research has been conducted on the use of social networks in the day

to day management of projects, especially related with communication and there is even talk about collaborative project management.

CRITICAL REVIEW OF THE TRAINING AND COMPETENCES OF THE PROJECT MANAGER

Notwithstanding the above, certain limitations have been described in the approach by competences (Humphreys et al., 2018). Surely, the biggest criticism resides in the tendency to divide certain competences into other simpler ones, which also facilitates evaluating them. However, mastering the basic blocks does not imply possessing the higher order abilities and being capable of applying these basic blocks in real contexts (Huddle & Heudebert, 2007). These higher order abilities have been called meta-competences or general competences. In the project management sector, competences of these characteristics have already been defined but have not been placed in hierarchical order; perhaps there are still too many and certainly there is a lack of consensus about them. Also, a clear distinction has not been made between the specific competences of project management and the competences considered transferable; in other words, they are demanded in other career fields.

Regarding the list of competences of the two main world project management standards, we miss having meta-cognition included in this list. Literally, meta-cognition means cognition or knowledge about cognition. This is the knowledge of our own thought processes and plays a significant role in resolving poorly structured problems (Santoso et al., 2017). It is considered to improve awareness, controlling the cognitive creation of information and the development of regulation strategies throughout the learning process (Biasutti & Frate, 2018). It implies having three essential skills (Woolfolk, 2019): planning, verification and evaluation. These skills are constantly being used in project management; when prescriptive methodologies are used as well as when it is based on agile methodologies. Not all learning requires meta-cognitive abilities, but this is a particularly useful competence for learning throughout life and is explicitly acknowledged in other professions (Lonie & Desai, 2015; Medina et al., 2017).

Meta-cognition has also been linked to groups and different terminology has been used like for example, group cognition, shared cognition, group conscience and transactive memory (Biasutti & Frate, 2018). They refer to the ability to reflect on the cognitive ability of the group throughout the collaboration that is being carried out.

Other competences that are raising interest in other career fields are the ability to reflect. The PMI model sporadically mentions reflection, but it is not a specific competence. The IPMA model includes it in People 1: “Self-reflection and self-management”. In any case, it seems to be a reflection “of the situations” and not “in the situations”. It seems to be more of a personal resource for achieving specific competences and it is also a competence objective to be acquired and improved.

Finally, and to conclude with a review of the specific list of competences, the PMI model does not explicitly include personal development competences such as the managing of your own emotions, resilience, stress management, the acceptance of your own errors and the search for assistance.

In summary, a uniform list of competences does not exist. A taxonomy is required as well as the use of importance as a criteria, favoring important general competences (Nijhuis et al., 2018).

The authors of this chapter would like to gather the reflections of Cicmil et al. (2016) about vulnerability and unsustainability in project-based work. The competences movement is aimed to fulfil the

challenges that nowadays projects face. However, there seem to be a lack of criticism of working conditions in terms of deadline stress and overload.

FUTURE RESEARCH DIRECTIONS

In the opinion of the authors of this chapter, the main standards and training programs for current and future project managers are not taking meta-cognition into account as part of their competences and others are still being considered in a still limited way such as self-cognition, reflection, managing your own emotions, stress or resilience. While in agreement with the opinion of Nijhuis et al. (2018), regarding the lack of a uniform list of competences, the authors of this work demand going a step further, which is to design a general agreed-upon model of meta-competences; in other words, competences that ensure knowledge and abilities are applied to the professional activities in the real world, to include evaluation in real contexts.

Although the first steps have already been taken, a clear line of work to consider is to conduct a study for determining how to combine the individual competences of project managers with those of the project team and those of an organization that is tackling projects.

The authors of this chapter join the call made by Ballesteros-Sánchez et al. (2017) to conduct a study that will allow us to better understand the key competences of the project management profession as well as how to effectively improve them. In this sense, few studies have been found that cover aspects such as coaching, the use of social networks, etc., in project management; at least a lot fewer than in other disciplines. The research that has been conducted to date on how the competences of project managers may be taught and learned is limited (Ashleigh et al., 2012). On the other hand and although the main standards widely include the concept of developing competences throughout one's lifetime, the authors understand that more research is required on how the project management professionals of today are trained in a manner that is self-regulated and reflective while they are carrying out their work. Likewise, there is a lack of analysis regarding the current and future role that digital technologies have and will have in this process.

Finally, an aspect that should also be researched in-depth in future studies is the methods used at assessment organizations and updating the competences acquired by project managers through a self-learning program that allows to better assign projects to available managers at the company based on the specific characteristics and needs of the projects.

CONCLUSION

The aim of this chapter has been to present a critical and constructive interpretation of the current state of competences training of project managers, arranged according to the holistic framework presented at the beginning of the chapter. The proposed holistic framework is based on four elements: competences, learning approaches, training scenarios and levels of analysis.

Notable progress has been made to date but the demands faced by professionals in this area are undoubtedly needed and there is still a lot of work to be done. The most immediate challenges are creating an agreed upon and hierarchical list of competences for the project manager as well as a study of the competences in projects at the project team level and at the organizational level. What is the best way

to acquire and improve the level in each one of these competences will be another milestone that needs to be reached.

From a more specific point of view, different elements have been compiled that could play an important role in competences training of project managers like for example, meta-cognition, group learning, self-regulated learning, experiential learning, e-learning and social networks.

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KEY TERMS AND DEFINITIONS

Community of Practice: Network of professionals that share experiences and knowledge, normally through specific Internet platforms for the purpose of generating professional knowledge.

Competence: Know how in specific situations that require applying knowledge, abilities and attitudes in a creative, flexible and responsible way.

Cooperative Learning: Situations where several trainees work together to achieve shared learning goals. Creating, interpreting, explaining and discussing are a comprehensive part of the group activity.

E-Learning: Virtual learning space aimed at facilitating the experience of distance training for companies as well as for educational institutions.

Experiential Learning: Learning based on professional experience. It must be planned and subsequently evaluated.

Meta-Cognition: Knowledge about our own thought processes.

Reflective Learning: Thoughtful and inventive learning. Personnel involved reflect prior, during and after learning situations, analyzing what has happened and the reasons why to improve in the future.

Self-Regulated Learning: Learning that occurs independently and throughout one's lifetime. For this, students must activate and maintain their thoughts, conducts and emotions in order to reach their own training goals.

Chapter 9

Risk Management in Small Hydroelectric Power Plants (SHPPs) in Colombia

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ABSTRACT

Although Colombia has more than 50 years of experience developing hydropower projects, the recent Hidroituango project crisis has opened the debate regarding risk management (RM) in generation power projects, especially for non-conventional renewable energy sources (NCRES) where there are no academic studies for Colombian case. This chapter develops a methodological proposal based on PMBOK, ISO standard, and Colombian technical standards, that will allow identification, assessment, and management of the risks inherent in small hydroelectric power plant (SHPP) projects. All this in the context of the opportunities generated by Law 1715 of 2014 and the mega global trend of transition from fossil sources of energy to NCRES. The methodology was built based on: a state of the art review, an expert's knowledge consultation, and a Delphi expert's assessment analysis. The result is a project risk management methodology that includes: holistic identification of risk variables in SHPP projects, assessment of experts and response to inherent and residual risks.

INTRODUCTION

United Nations' 17 Sustainable Development Goals, stated on its 7th goal, that sustainable energy development is an opportunity to ensure access to affordable, reliable, sustainable and modern energy for needed people living on developing countries (Kates, Parris, & Leiserowitz, 2016). The increase in the use of fossil fuels combined with the increase in the global population has caused that earth resources

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are getting closer to a dangerous point of no return for life as known, which is recognized as one of the social problems of our time by key scientists, politicians and religious leaders at a global level. Citing the top leader of the Catholic church: “There are not just two separate crises, an environmental and a social one, but just one and complex socio-environmental crisis” (Pope Francis, 2015). The effect of the abuse of fossil fuels on the environment is devastating. The most frightening aspect is the fact that in recent decades of this new century, the consumption of fossil fuels has increased. This has contributed to the emission of greenhouse gases and the release of pollutants in the atmosphere that has serious consequences, including global warming. Therefore, it is necessary to protect planet Earth through the incorporation of renewable energy sources, which are respectful to the environment.

In the local Colombian context, factors such as: energy sovereignty, the phenomenon of “El Niño” (Collins, An, & Cai, 2010; Cai & Borlace, 2014; Hoyos, Escobar, Restrepo, Arango, & Ortiz, 2013), the exhaustion of energy fossil fuels, and specifically the dramatic decrease of natural gas reserves (Mining and Energy Planning Unit of Colombia; UPME, 2016a). As well as to meet the commitments made by Colombia at the Paris Climate Change Summit (García Arbeláez, Barrera, Gómez, & Suárez Castaño, 2015), which are comparable with those of other countries in the region and that sets forth the 20% reduction of its greenhouse gas emissions by 2030; the country shall promote the use of NCRES (Gualteros & Hurtado, 2013), as well as a more efficient energy management (Mining and Energy Planning Unit of Colombia; UPME, 2016b) (UPME, 2015) & (Pardo Martínez & Alfonso Piña, 2015). Project development of NCRES in Colombia has been leveraged by Law (LEY 1715, 2014), pursuant to which the integration of non-conventional energies (geothermal, wind, solar, biomass and SHPPs) in the National Energy System (SEN) is encouraged. This law has two objectives: a) to promote the development of non-conventional energy sources, integrating them to the national energy system, and b) to promote energy solutions to rural and isolated areas of the country. All efforts coordinated between academia, and the electricity industry to improve the effectiveness and efficiency of NCRES and particularly in the SHPP projects, its integration into the National Energy System are in line with the National Government’s energy sovereignty objectives (Departamento Nacional De Planeación (DNP), 2017; Consorcio Energético CORPOEMA, 2010).

Risk management is one of the tasks in which investors and organization’s management gets more directly involved and concern. In fact, the impact of Enterprise Risk Management (ERM) is measured in the performance of many organizations (Lai & Shad, 2017). The purpose of generating a guide for the ERM, as a controllable and streamlined “process” that formulates the path tasks and operations for functional areas of management, so that the risks identified do not curtail the company’s strategic plans. It is like a key element for the contribution to the perdurability of organizations committed with the development of power generation projects of NCRES, which coincides with the guidelines of the Masters in Direction and Management at the Universidad del Rosario. This methodological proposal will be developed for those organizations that decide to include in in the corporate objectives of: innovation, environmental sustainability, actions against global warming, social sustainability, economic sustainability and optimization of energy resources by the development of SHPP projects in their strategic plants as a point of integration.

From all Non-Conventional Renewable Energy Sources (NCRES), Colombia has more than 50 years of experience developing Small Hydroelectric Power Plant (SHPP) projects, but risk management remains as the main concern among investors. Literature review shows that technical and financial issues have been covered, mainly for the transference of expertise from large hydropower projects to SHPP projects, but it is required a holistic point of view that discusses other variables such social and environmental

that can deeply impact SHPP projects. Some SHPP projects execution have been seriously threatened by risks beyond technical and financial issues in Colombia. Thus, an holistic perspective of RM that discusses other variables such social and environmental is required for NCRES projects. This shall to be done sorted by energy power source in accordance with the manner in which they are obtained: biomass, geothermal, from the sea, wind, solar and SHPP (S.R. Bull, 2001).

The main goal of this review paper is to present a methodological tool that allows to identify and analyze the main risks involved in the execution of generation projects in SHPPs (< 10MW) in Colombia under the guidance of Colombian Technical Standards NTC5254 and NTC-ISO-31000-2011 (Icontec, 2004) & (Icontec, 2011). The contribution of this research consists on develop the first methodological proposal based on PMBOK, ISO and Colombian Technical Standards that will allow to identify, assess and manage the risks inherent in SHPPs projects in Colombia. This paper is organized as follows: in Section 2 the current state of Small Hydro Power Generation in Colombia and its associated risk management is presented. Section 3 briefly defines the methodology used to collect data. Section 4 presents the results of identifying, organizing and assessing risks. Finally, Section 5 reflects both the conclusions of the research as well as discussion of recommendations to resolve potential mitigations. Because of in Colombia a SHPP can last more than 2 years on feasibility phase a case study is not in the scope of this work. Because of in Colombia a SHPP can last more than 2 years on feasibility phase a case study will be on the scope of future researches.

BACKGROUND OF SMALL HYDRO POWER GENERATION IN COLOMBIA AND LITERATURE REVIEW

According to UPME's 2011 report (Mining and Energy Planning Unit of Colombia; UPME, 2006) & (Mining and Energy Planning Unit of Colombia; UPME, 2016c) the composition of the production of Colombian electricity has multiplied by 5 in the last 35 years, as shown in Figure 1. This means that there has been a 15% annual growth, but unfortunately the diversification of the sources has been only 4.5%. The Colombian electric-energy sector has had several regulatory reforms. The most notable reform is the one that arose from the 1992 energy crisis because of the "El Niño" phenomenon. This crisis known as "The blackout", brought serious consequences to the country's agricultural and industrial production. Since then, regulations have been directed to: meeting the demand, at the lowest cost and guaranteeing the reliability of the supply (UPME, 2015) & (Mining and Energy Planning Unit of Colombia; UPME, 2016c). As also shown in Figure 1, the generation sources in Colombia are concentrated in large technologies for hydroelectric power plants (with dams) and conventional thermal plants powered with both carbon and gas, which is worrisome with respect to the shortage of natural gas in Colombia within the next years (Mining and Energy Planning Unit of Colombia; UPME, 2006). In a positive scenario, the natural gas reserves offer autonomy until 2024 and in a crisis scenario, because of every eight years the "El Niño" phenomenon, there could be shortages by the end of 2018 (Mining and Energy Planning Unit of Colombia; UPME, 2016a).

On the other hand, from the seven technologies identified NCRES, the current composition of those that are interconnected to the National Interconnected System (SIN) in Colombia is as shown in Table 1:

Field survey was done to stablish SHPP installed base. There were found 105 SHPPs grouped in companies and installed capacity as shown in Table 2.

Figure 1. Evolution electricity production in Colombia by source 1975-2016

Source: (UPME, 2015) & (Mining and Energy Planning Unit of Colombia; UPME, 2006)

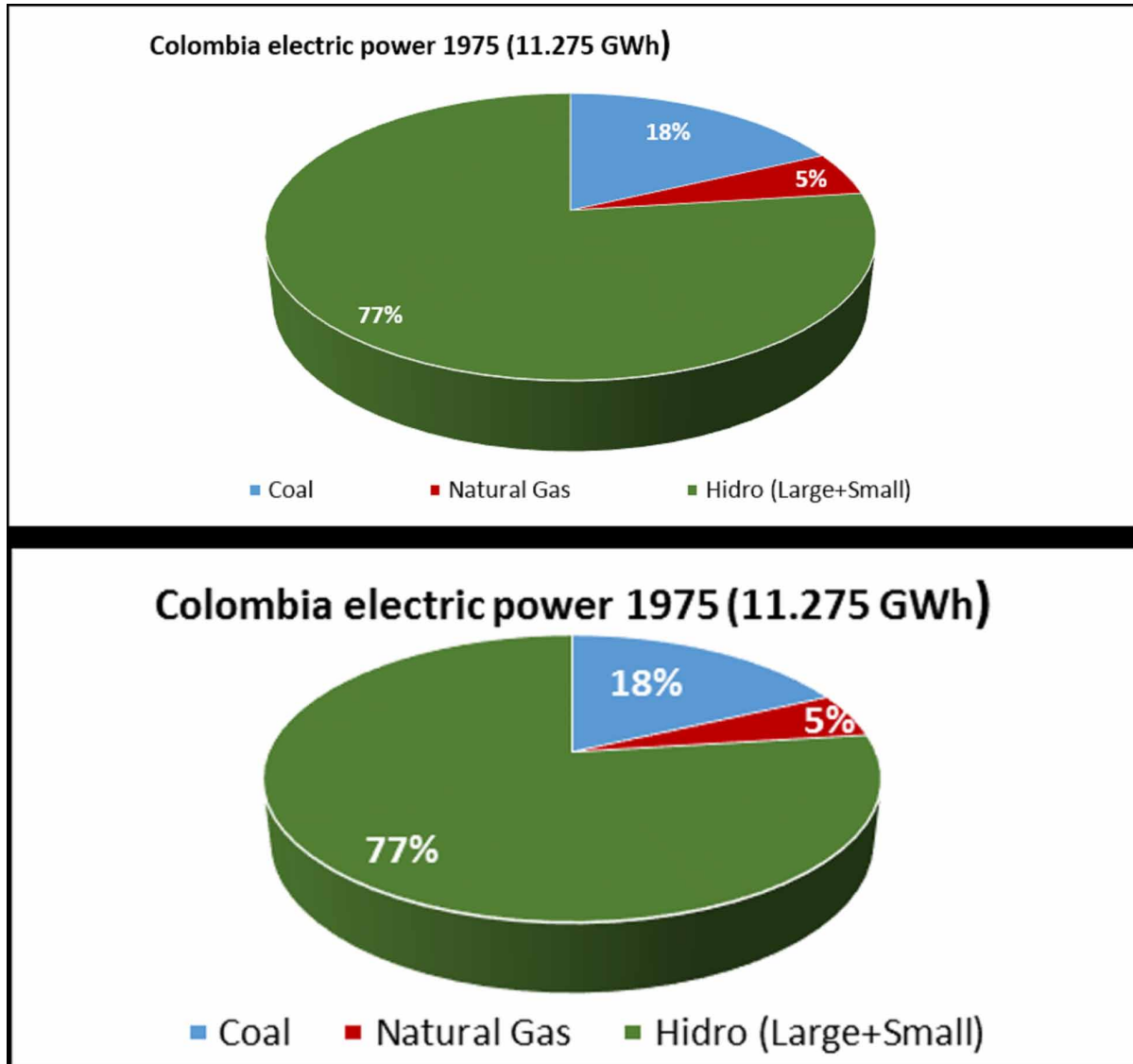


Table 1. Participation of NCRES technologies with high installed capacity in Colombia

Technology	Current Installed Capacity (MW)	Market Share
SHPPs	719,57	93,9%
Biomass	26,9	3,0%
Wind	19,5	2,2%
TOTAL	765,97	100,0%

(Source. Own elaboration)

Source: (Renewable Energy Policy Network for the 21st Century REN21, 2016), (Mining and Energy Planning Unit of Colombia; UPME, 2006) & (Mining and Energy Planning Unit of Colombia; UPME, 2016c)

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The expectations of the government are to go from a participation of NCRES in SIN from 3.5% to 6.5% (even in non-interconnected areas the expectation is to reach 30%) by 2020. This when the installed capacity in Colombia will be 18,000 MW, which will mean that there will be an increase from the current 765,97 MW to 1.423 MW in NCRES. In summary, will needed an increase of 657 MW in generation with NCRES, which is to double installed capacity on NCRES, where biggest potential is in SHPP. This is possible from the perspective of natural resources, since Colombia has the potential for

Table 2. Colombian electric companies by installed capacity and number of SHPP

Company / Agent Operator	Capacity/ MW	Number of SHPPs
TOTAL	719,57	105
Aes Chivor & CIA. S.C.A. E.S.P.	19,7	1
CCG Energy S.A.S. E.S.P.	1,48	1
Celsia S.A E.S.P.	39,8	2
Cemex Energy S.A.S E.S.P.	7,25	2
Central Hidroeléctrica Concordia S.A.S. E.S.P.	5,7	1
Central Hidroeléctrica el Edén S.A.S. E.S.P.	20,6	
Centrales Eléctricas de Nariño S.A. E.S.P.	27,13	5
Compañía de Electricidad de Tuluá S.A. E.S.P.	14,17	3
Electrificadora Del Huila S.A. E.S.P.	11,14	3
Emgesa S.A.E.S.P.	110,91	10
Empresa de Energía de Pereira S.A.E.S.P.	8,5	2
Empresa De Energía Del Pacífico S.A.E.S.P.	72,57	6
Empresa Multipropósito De Calarcá S.A.E.S.P.	2	3
Empresa Municipal De Energía Eléctrica S.A.E.S.P	4,5	1
Empresas Públicas De Medellín S.A.E.S.P.	156,26	27
Enerco S.A.E.S.P.	7,55	3
Energética S.A.E.S.P.	1,2	1
Energía Del Rio Piedras S.A.E.S.P.	7,29	1
Energía Renovable De Colombia S.A.E.S.P.	2,28	1
Generadora Alejandría S.A.S.E.S.P.	15	1
Generadora Colombiana de Electricidad S.A.E.S.P.	0,38	1
Genercomercial S.A.S.E.S.P.	1,03	1
Generputumayo S.A.S.E.S.P.	0,94	2
HZ Energy S.A.S.E.S.P.	6,35	3
IAC Energy S.A.S.E.S.P.	4,8	1
Isagen S.A.E.S.P.	19,9	1
La Cascada S.A.S.E.S.P.	91	7
Risaralda Energía S.A.S.E.S.P.	19,9	1
Vatia S.A.E.S.P.	40,24	14

(Source. Own elaboration)

hydro power generation (UPME, Pontificia Universidad Javeriana PUJ, Departamento Administrativo de Ciencia, Tecnología e Innovación COLCIENCIAS, Instituto de Hidrología; Meteorología y Estudios Ambientales IDEAM, 2015) and it has been classified by the International Renewable Energy Agency (IRENA), as the fourth country in the world with the highest potential of hydraulic generation (International Renewable Energy Agency IRENA, 2016) and the second in Latin America (see Figure 2). In total, per the National Energy Plan (PEN) (UPME, 2015), the potential of the SHPPs in Colombia was estimated at 25.000 MW, of which, according to an inventory of the National Non-Conventional Energy Program, UPME, CORPOEMA, IRENA and the Universidad Nacional de Colombia (UPME, Pontificia Universidad Javeriana PUJ, Departamento Administrativo de Ciencia, Tecnología e Innovación COLCIENCIAS, Instituto de Hidrología, Meteorología y Estudios Ambientales IDEAM, 2015), (International Renewable Energy Agency IRENA, 2016) & (Flórez, 2006). To this potential, it must add that the price of MW/h with SHPPs in Colombia is below than the world average (Lozano & Rincón, 2010) (see Figure 3). With all the above, under a neutral scenario, it is estimated, that Colombia will duplicate the construction and the upgrading (Ortiz-Flórez, Chicango-Angulo, & Arias-Chasqui, 1996) of SHPP projects in the next decade.

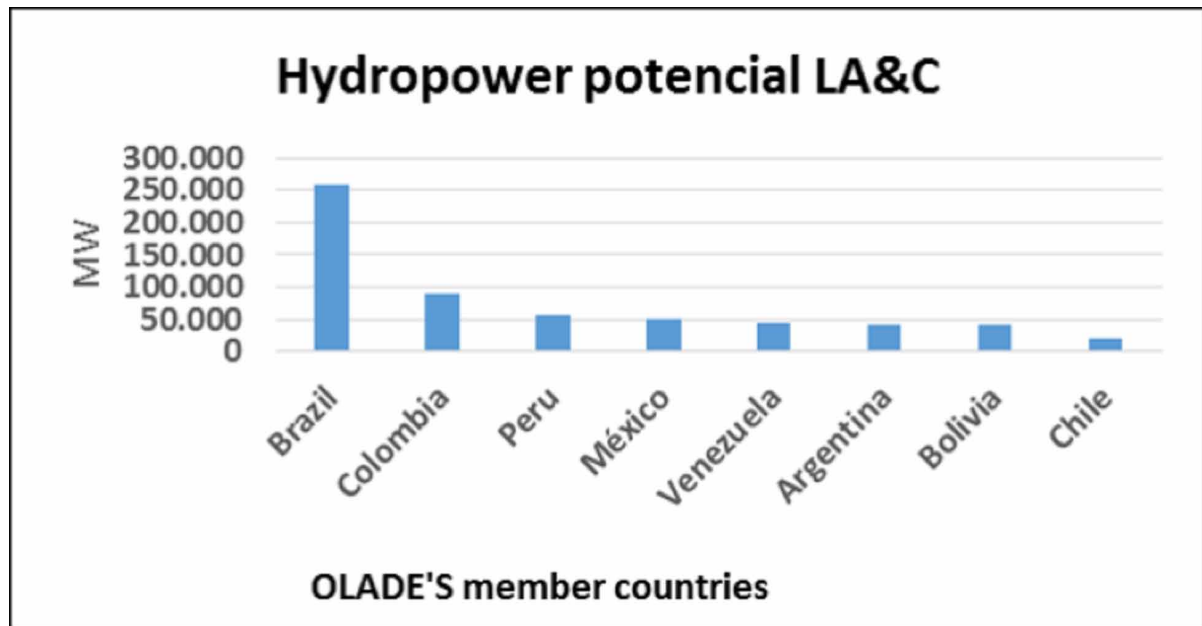
In spite of having this great potential, in Colombia, only 3% it has been exploited in SHPP projects (Mining and Energy Planning Unit of Colombia; UPME, 2016c), (UPME, Pontificia Universidad Javeriana PUJ, Departamento Administrativo de Ciencia, Tecnología e Innovación COLCIENCIAS, Instituto de Hidrología, Meteorología y Estudios Ambientales IDEAM, 2015) & (International Renewable Energy Agency IRENA, 2016), due to several factors such as technical, market, economic, political, institutional, social and environmental barriers (Kim, Park, & Kim, 2017), (Morales, Álvarez, & Acevedo, 2015) & (Gallego, Franco, & Zapata, 2015). Given the complexity on the nature of the SHPP projects, given the number of variables and their non-linearity; The need for a management system that allows reducing the uncertainty in the achievement of the objectives and having a plan of action in different unforeseen scenarios or exceeding the desired values in said variables is appreciated.

In accordance with the classification given by renewable energy global experts (S.R. Bull, 2001), cited law has established six types of renewable energy according to the manner in which they are obtained: biomass, from the sea, geothermal, wind and solar and SHPP. It is important to note that when preparing this article, the regulations in Law (LEY 1715, 2014) still has some pending matters by some state entities such as the Ministry of Mining and Energy, the Ministry of the Environment and the CREG [Spanish acronym for Energy and Gas Regulatory Commission]. Colombian Law (LEY 1715, 2014), indicates the tax and financial benefits for investment in NCRES projects that are following listed:

- Income tax deduction as an incentive for research, development and investment in the context of production and use of energy through NCRES. The benefit consist in a “right to reduce from their income on a yearly basis for the next 5 years to the taxable year in which they have made the investment, fifty percent (50%) of the total amount of the investment made”, with the condition: That the amount to be deducted does not exceed 50% of the taxpayer’s liquid income determined before deducting the amount of the investment and that the environmental benefit of the investment has been certified by the Ministry of the Environment and Sustainable Development
- Value Added Tax: Equipment, items, machinery and local or imported services that are destined to pre-investment and investment for the production and use of energy from non-conventional sources, as well as for the measurement and assessment of potential resources will be excluded from VAT. The benefit is conditioned to two circumstances: that the Mining and Energy Planning

Figure 2. Hydroelectric potential

Source: (UPME, Pontificia Universidad Javeriana PUJ, Departamento Administrativo de Ciencia, Tecnología e Innovación COLCIENCIAS, Instituto de Hidrología, Meteorología y Estudios Ambientales IDEAM, 2015), (International Renewable Energy Agency IRENA, 2016)



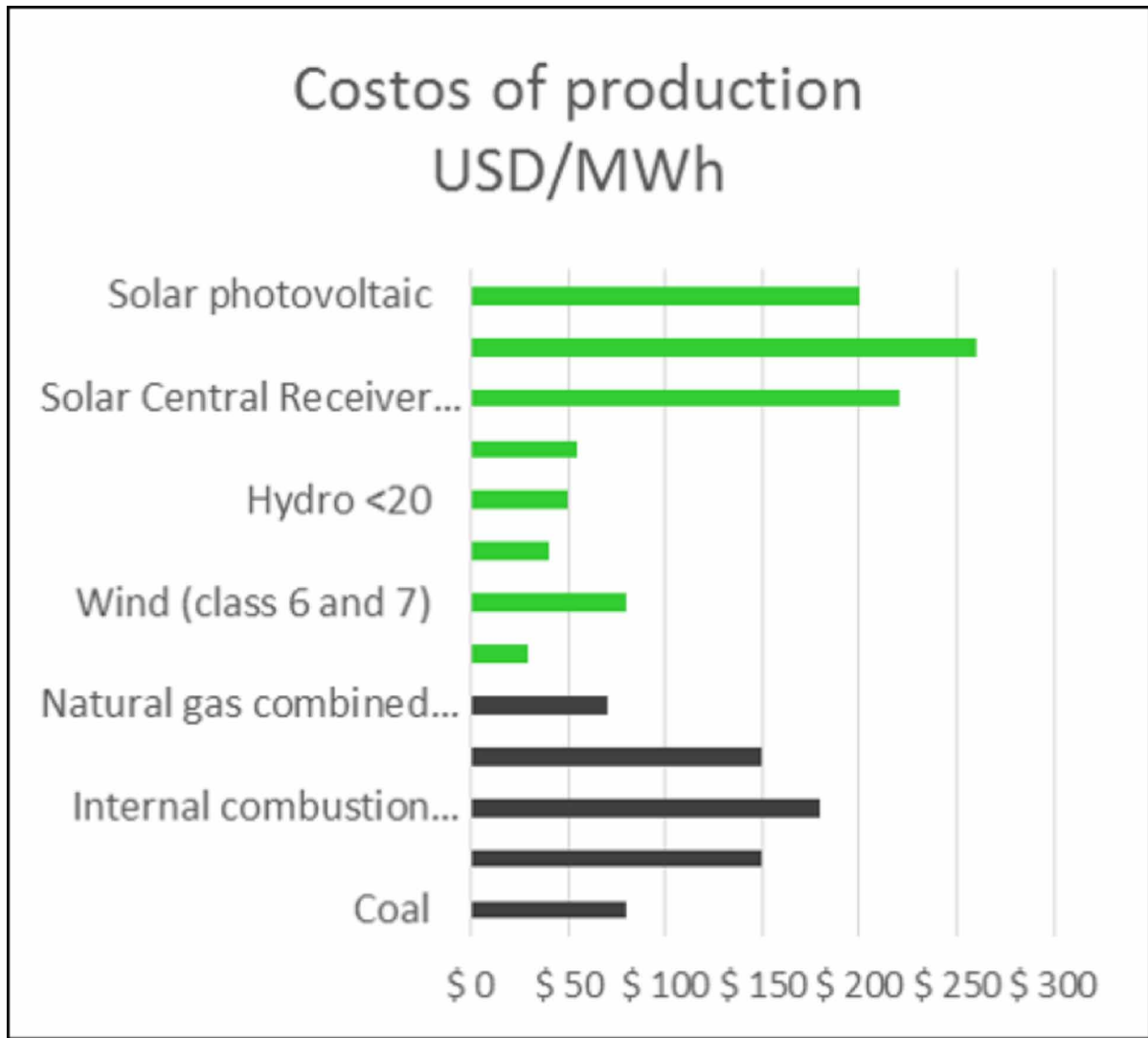
Unit [UPME - for its acronym in Spanish] issue a list of what equipment, services are used for the above-mentioned purpose, and that the Ministry of the Environment and Sustainable Development certifies that equipment and services are excluded from VAT.

- Exemptions from customs duties: This applies to the titleholders of new investments in new NCRES projects with respect to the importation of: machinery, equipment, materials and inputs. The requirements are a.) Exclusive destination to pre-investment and investment activities in NCRES projects and b.) Absence of local production and that its own means for acquisition is subject to the importation.
- Accelerated depreciation: will be applicable to the machinery, equipment and civil works necessary for the pre-investment, investment and operation of the generation with NCRES that are acquired and/or built exclusively for this purpose, as of the entry in force of this law. For these purposes, the annual depreciation rate will not be greater than twenty percent (20%) as an annual global rate. The rate could vary on a yearly basis by the project titleholder, prior notice to the DIAN [National Tax and Customs Administration], without exceeding the limit established in this article, except in the cases in which the law authorizes greater global percentages.

With all the above-mentioned incentives, an increase in the amount of SHPP projects registered before UPME is expected. Therefore, a risk management system for NCRES projects is necessary. The intended methodological proposal seeks to serve as reference to define the resources to commence, execute and control a process for risk management in SHPP projects in Colombia. The description of this process ends with the development of a practical guide that in the future could be used to develop

Figure 3. Renewable energy production costs

Source: (International Renewable Energy Agency IRENA, 2016)



similar projects that are geared towards other non-conventional renewable energy technologies such as geothermal, wind, solar or biomass. Our specific objectives are: a) to identify the main risks presented in small hydroelectric power plant SHPP projects in Colombia; b) to assess the risks identified, qualify and quantify them for their treatment and c) to elaborate a methodology supported under the guidance of Colombian Technical Standard NTC5254 and NTC-ISO-31000-2011 (Icontec, 2004) & (Icontec, 2011), allows to manage the risks for SHPP projects in Colombia.

METHODOLOGY

According with (Hernández, Fernández, & Baptista, 2014), the approach of this research is quantitative, mainly because of data collection mode:

“The collection is based on standardized instruments. It is uniform for all cases. The data are obtained by observation, measurement and documentation. We use instruments that have proven to be valid and reliable in previous studies or are generated new based on the review of the literature and are tested and adjusted. The questions, items or indicators used are specific with answer possibilities or predetermined categories”

And because of data analysis:

“systematic and standardized, intensive use of statistics (descriptive and inferential), based on variables (a matrix), impersonal, done after data collection”.

The methodology followed in this research is analytical, descriptive and transverse. A bibliographical review of the global literature was made in specialized scientific journals and databases. such review (See Table 3) shows that RM on renewable energy has been widely addressed in technical and financial issues and very focused in NCRES such as wind and solar. Any research in RM focused on SHPP was found. Elaborating a categorization of that by region, the outcome is: Europe (Klessmann, Nabe, & Burges, 2008) & (Kitzing, 2014), North America (Lee & Zhong, 2015). Latin America (Dyner, Arango, & Larsen, 2006) & (Guerrero-Liquet, Sánchez-Lozano, García-Cascales, Lamata, & Verdegay, 2016). In Colombia SHPP projects Colombia has traditionally focused on technical (Ortiz-Flórez, 2001) and financial issues (Sánchez, Lozano, & Manotas, 2014; Dagoumas, Koltsaklis, & Panapakidis, 2017). For all the above it is said that the relevance of this research is that any RM holistic approach for Small Hydro (SHPP) has never been done before in Colombia.

Expert judgment was done by applying the techniques recommended by Dorofee (Dorofee, Walker, & Alberts, 1996) and the Project Management Institute (PMI) (Project Management Institute, 2013). The barriers and risks involved in the development of SHPP projects were consulted, identified, classified and documented as variables. It was investigated how the SHPP projects are implemented, controlled and adapted during unplanned crises. The risk profile of the SHPPs sector in Colombia was typified and, finally, under the guidance of Colombian Technical Standards NTC5254 and NTC-ISO-31000-2011 (Icontec, 2004) & (Icontec, 2011), a methodological proposal to be used as a reference, that optimize the development of risk management in SHPP projects in Colombia, which includes: identification of the main risk variables; qualification; quantification; evaluation and response to these risk variables as shown in Figure 4.

The identification of the risks was based on the characterization of the uncertainty that affects the objectives of the project, producing damages. For the development of this paper review, experts on projects of SHPPs from different companies involved on different phases of the projects in Colombia were consulted, as indicated in Table 4.

Table 3. Global Literature reviewed for State of art on risk management on renewable energy or SHPP

Titles that issue researches on renewable and Small Hydro SHPP
Energy Policy: The International Journal of the Political, Economic, Planning, Environmental and Social Aspects of Energy
Energy The: International Journal
Environment Magazine
Global Business and Management Research: An International Journal
Hydro Review
IEEE Latin America Transactions
IEEE Spectrum
Indian Journal of Power and River Vally Projects
International Conference on Small Hydro
International Journal of Water Power and Dam Construction
International Journal on Hydro
Irrigation and Power Journal
Journal of Cleaner Production
Renewable & Sustainable Energy Reviews
Renewable Energy an International Journal
Small Hydropower News
Sustainability — Open Access Journal

(Source. Own elaboration)

Identification and Categorization of Risks

To avoid bias and improve the identification of risk variables, with the help of experts, a list of events that cause adverse situations in the execution was elaborated. An organized categorization was gotten according to the following topics: Technical; Financial; commercial; Political, ethical and legal; Organizational; Environmental, and Community-related (Kim et al., 2017), (Morales et al., 2015), (Flórez, 2006), (Wüstenhagen, Wolsink, & Mary Jean Bürer, 2007), (Rosso-Cerón & Kafarov, 2015) & (Diez Hernández & Olmeda Sanz, 2013).

Qualification and Determination of the Severity of the Risk Using the Matrix Impact-Probability of Occurrence:

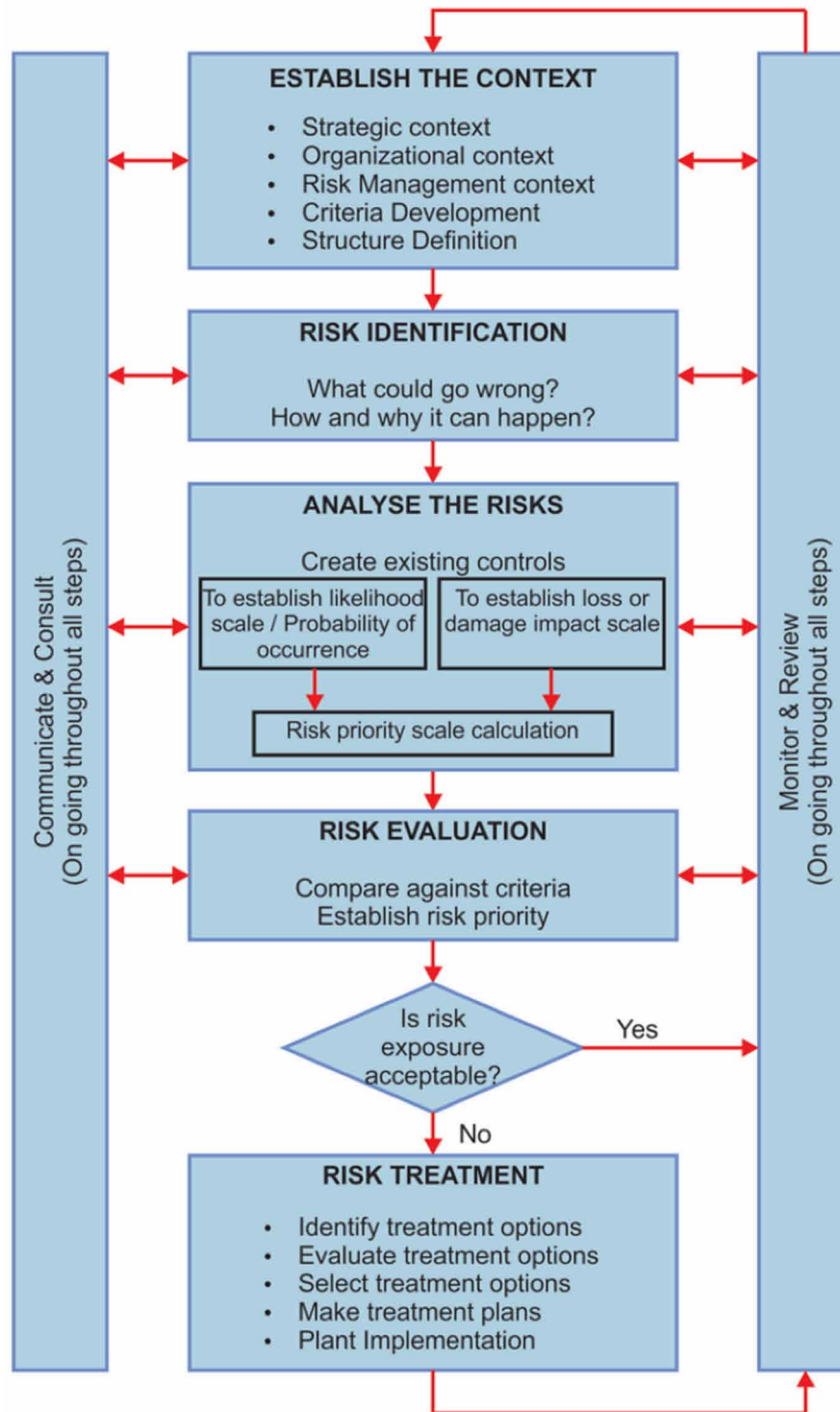
A RM that ensures the successful development of projects, must define the risk value. It was started by identifying if there is a threat or an opportunity, for this it is necessary to assign a probability of occurrence and an impact to the objectives of the project (see Table 5).

Defined assessments for risk impact scales for the main project objectives:

For the evaluation and, to avoid limiting itself to the technical variables associated with the works and the equipment, it was decided to use a combination of Delphi technique and expert judgment (see Table 6).

Figure 4. Risk management process

Source. (Icontec, 2004)



Risk Management in Small Hydroelectric Power Plants (SHPPs) in Colombia

Table 4. SHPP companies in Colombia where experts were consulted for this review

Power Generation Companies	Engineering and Construction Companies	Equipment Supply Companies
Celsia	AIA	Andritz
CHEC	Sedic	Hidroturbinas Delta
Emgesa	Gomez Cajiao	Nidec-Leroy Somer
Enerco	I-Consult	Voith
Epm	Ingetec	
Epsa	Integral	
Generadora union	Mincivil	
Generadora Alejandria	Rightside	
Genmas	Pi-epsilon	
Grupo Elemental		
HMV		
Isagen		
Latinco		
UT-Choc		

(Source. Own elaboration)

Table 5. Risk priority scale: probability / impact matrix

Likelihood or Probability of Occurrence	Very High (Certain)	10	Almost certain	Moderate	Important	Intolerable	Intolerable	Intolerable
	High (Almost Certain)	8	Tolerable	Tolerable	Moderate	Important	Intolerable	Intolerable
	Medium (Likely)	6	Tolerable	Tolerable	Tolerable	Moderate	Important	Important
	Slight (Possible)	4	Unlikely	Trivial	Trivial	Tolerable	Moderate	Important
	Low (Unlikely)	2	Rare	Trivial	Trivial	Trivial	Tolerable	Moderate
	Very Low (Rare)	1	Insignificant	Insignificant	Mild	Medium	Severe	Catastrophic
			1 Insignificant	2 Minor	4 Intermediate	6 Elevated	8 Severe	10 Catastrophic
	Impact							

(Source. Own elaboration)

RESULTS

Once the experts' judgment was consulted and organized on Table 7. The topics of risk were quantified. The parts of the process that are affected by these types of risk are identified during the SHPP project. It is explicitly explained what the risk consists in, if it becomes an event. Subsequently, the probability of occurrence and the impact that the event will have on the execution of the project is qualitatively assessed. Based on this weighting and per the percentage values of the risk impact scale matrix (Table 4), the value of the risk is quantified where 100% is the maximum value.

Categorization and weighting of risk variables for SHPP projects in Colombia are shown in Table 7.

Management of Risk Variables, Response and Action Plans:

There are different ways of approaching the actions to be taken against the risks that arise in the development of a project, as listed below:

- Avoiding the risk: not to continue with the risky activity (Not always possible)
- Transferring the risk: that another party assumes part of the risk (To think which new risks cause this change)
- Reducing the risk: take measures tending to reduce the probability of occurrence and/or impact, (Does not always imply additional financial costs, It can even save money)
- Accepting the risk: accept the inherent risk (But with knowledge)

Table 6. Matrix scales of impact in the risk

Type of risk	Relative or absolute scale (For negative impacts)					
Technical	Insignificant /.05	Slight /.1	Medium /.2	High /.4	Severe /.6	Catastrophic /.8
Financial	Insignificant loss	< 10% loss	10 – 20% loss	20 – 30% loss	30 – 40% loss	> 40% loss
Political, ethical and legal	Decrease barely noticeable	Minimal affected areas	Major affected areas	It requires board of directors' approval	Unacceptable reduction for shareholders	Useless end result
Organizational	Decrease barely noticeable	Minimal affected areas	Major affected areas	It requires board of directors' approval	Unacceptable reduction for shareholders	Useless end result
Environmental	Degradation barely perceptible	Only specific parts of the project are impacted	Reduction requires Management approval	Reduction requires board of directors' approval	The unacceptable reduction for shareholders	Useless end result
Relationship with communities	Degradation barely perceptible	Only specific parts of the project are impacted	Reduction requires Management approval	Reduction requires board of directors' approval	The unacceptable reduction for shareholders	Useless end result
Impact	Insignificant	Minor	Medium	Elevated	Severe	Catastrophic

(Source. Own elaboration)

Risk Management in Small Hydroelectric Power Plants (SHPPs) in Colombia

Table 7. Risk identification matrix in SHP projects

Type	Process or Work Activity	Risk	Probability	Impact	Risk Value
Technical	Pre-feasibility and conceptual engineering	Excess of sensibility in the positive and negative scenarios that make the project unsustainable or dismiss qualitative elements.	Low	Severe	16% Tolerable
	Basic and detailed engineering	Not having detail engineering and go out to buy or bid with basic engineering. Changes in specifications or scopes	Slight	Severe	32% Moderate
	Civil works: Capture Gates, Driving, Equalization tank, Machinery room, Discharge	Changes in specifications or scopes Not provided work quantities Delivery times of suppliers different than the requested.	Slight	Severe	32% Moderate
	Electromechanical equipment: Inlet valve Turbine Generator Control and instrumentation system Substation interconnection line to SIN	Changes in specifications or scopes Not provided work quantities Delivery times different than the requested Incompatibility between equipment from different manufacturers	Medium	Elevated	36% Moderate
	Generic Turbines and Generators Generic Vs Taylor made equipment	Less energy generated, due to decreased efficiency of the turbo-generator.	Medium	Severe	48% Important
	Interconnection Point	Increase in the cost of substation and electricity grid to deliver the generated energy, because of late definition of the interconnection point by the network operator.	Medium	Catastrophic	60% Important
Financial	Costs	Costs structure different than planned	High	Severe	64% Intolerable
	ROI	Changes in timing or in levels in which investors recover their investment	High	Severe	64% Intolerable
	Project's cash flow	Disbursement of resources different than planned Change in payment terms to suppliers	High	Severe	64% Intolerable
	Exchange rates	Effects for drastic variation between currencies along project development. Difficulties in the linking of foreign capital resulting from the revaluation of the peso. High equipment imports costs due to the devaluation of the peso.	High	Intermediate	32% Moderate
	Credits	Changes in the rating of the investment risk. Changes in interest rates. Changes in amounts or deadlines for disbursements of resources Breach of obligations	Medium	Intermediate	24% Tolerable
	Taxes	Local or global taxes not contemplated in financial analysis	Medium	Intermediate	24% Tolerable
	Parafiscal charges and fees	Additional operation and maintenance workforce. Extra non-wage labor costs that must be added. Further benefits to unions	Medium	Catastrophic	60% Important
Commercial	Sale Fees	Different fees to those contemplated in the financial analysis	Medium	Catastrophic	60% Important
	Global and local market	Variations in commodity prices (e.g. Steel) that affect the cost of the investment. Variations in supply-demand of energy.	Baja	Minor	4% Trivial
	Entry into operation of other projects	Because of the entry into operation of new generation projects and increase in the available basket, decrease in the sale price of power	High	Intermediate	32% Moderate
	Clients	Changes in the objective energy consumer requirements	Low	Minor	8% Trivial
	Competitors	Price war	Low	Insignificant	2% Rare

continued on following page

Risk Management in Small Hydroelectric Power Plants (SHPPs) in Colombia

Table X. Continued

RESULTS ANALYSIS AND DISCUSSION

Type	Process or Work Activity	Risk	Probability	Impact	Risk Value
Political, Ethical and Legal	Licenses	Delays not contemplated in obtaining licenses Requirement of Licenses not contemplated in feasibility studies	High	Intermediate	32% Moderate
	Concessionaires	Elements not expressly considered in the concession agreement.	Slight	Severe	32% Moderate
	Employment agreements	Elements not expressly considered in the direct employment agreements or subcontractors	Slight	Intermediate	8% Trivial
	Sale of energy agreements	Lack of sale of energy agreements Changes in the elements of the same	Leve	Catastro-phic	64% Intolerable
	Agreements with suppliers	Changes in quotes and purchase orders or agreements with suppliers	High	Minor	16% Tolerable
	Agreements with subcontractors	Differences between the specifications requested or terms requested and those delivered	High	Minor	16% Tolerable
	Legal and legislative security	Changes in the law under which the project was evaluated. Legal or political elements of government not contemplated in the studies Changes in government	Medium	Severe	48% Important
Organizational	Poor planning process	Weak plants or lack of follow-up of planning	High	Minor	16% Tolerable
	Leadership	Changes in leadership or strategic personnel of the work team. Work environment elements in the project team	High	Insignificant	16% Tolerable
	Occupational health and safety management system	Work accidents. Deadlines are affected because of detection of anomalies in the audits	Medium	Intermediate	24% Tolerable
	Control and management documentation	Lack of policies, resources or an adequate C&D process	Medium	Minor	24% Tolerable
Environ-mental	Hydrology	River flow and/or its tributary levels different from those projected. Low levels of rainfall in the project's area of influence. Elements that modify turbidity or solid levels in suspension.	Low	Severe	32% Moderate
	Ambiental license	Times exceeded in the procedures required for environmental licensing to governmental entities, such as: Evaluation of the AAD UPME concept Evaluation of EIA Approval of the archaeological plan by ICANH.	High	Intermi-diate	32% Moderate
	Environmental regulatory changes	Changes in the competencies of the environmental authorities for the evaluation of the project. New conditions, procedures, fees and taxes for the licensing of the project.	Medium	Severe	48% Important
	Earthquakes	Telluric movements of higher levels than those contemplated in the studies	Medium	Mild	12% Tolerable
	Landslides	Earth movements or debris in places or at magnitudes not contemplated	Medium	Mild	12% Tolerable
	Avalanches	Changes in the riverbed because of land movements, debris or rocks in the course of the river and/or its tributaries	Medium	Medium	24% Tolerable
Relationship with the communities	Situation of the community	Area of influence different from the one defined in the studies. Social elements not contemplated in the area of influence	High	Intermediate	32% Moderate
	Social cartography and mapping	Deficient or non-existent survey of the social dimension in the areas of direct and indirect influence (ADI & AII).	High	Intermediate	32% Moderate
	Communication and public image	Lack of measurement or defects in the levels of perception of the community in the area of influence (ADI & AII). Lack of communication plans or defects in the same. Information leaks	Medium	Mild	12% Tolerable
	Project socialization	Defects or nonexistence of a plan for the relationship with the community. Lack of socialization of relevant parts of Risk Management plan to the community in the area of influence (ADI & AII). Changes in the social elements considered in the plan	Medium	Mild	12% Tolerable

(Source. Own elaboration)

Table 8. Risk profile

Risk aversion	It refers to when the investor would choose an investment with the lowest degree of risk versus two alternatives with the same level of expected profitability.
Risk Neutrals	In this situation, the investor would remain indifferent if he had to choose between two alternatives with the same level of expected profitability.
Prone to Risk	The investor would choose the investment with the highest degree of risk against two alternatives with the same level of expected profitability.

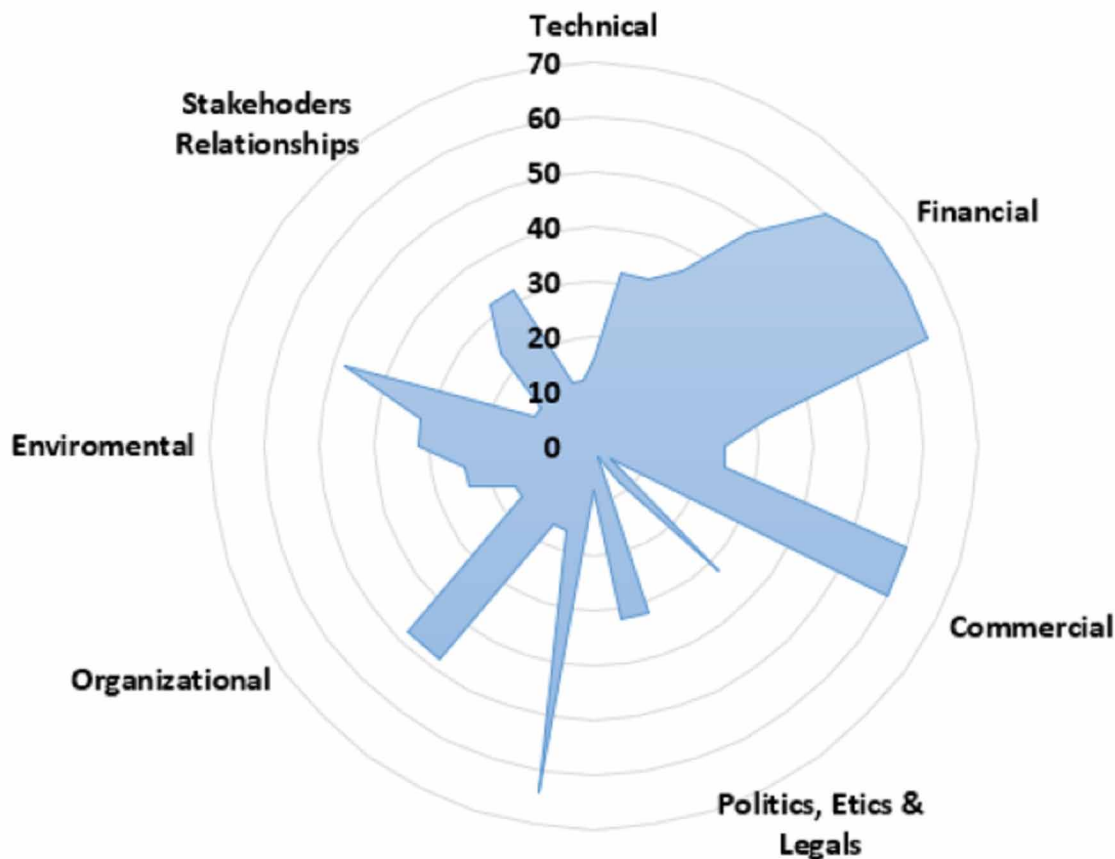
Source: (Das et al., 2010)

In accordance with the mathematical approach of the Markowitz model (Das, Markowitz, Scheid, & Statman, 2010), the behavior of a project manager who is responsible for maintaining the levels of return of the project is characterized by the degree of the risk aversion to the risk it has and the degree of maximization of the expected profit. There are three positions towards risk, summarized on the Table 8:

The results of current risk profile of the sector in Colombia by consulted expert's valuation is that the total average risk value of all risk variables is 31.3% (Neutral). The value of each of the categories

Figure 5. Current risk profile of the sector in Colombia

Source: own construction



is: technical 37% (Averse), financial 42% (Averse), commercial 21% (Prone), political-ethical-legal 33% (Averse), organizational 20% (Neutral), environmental 22% (Neutral), relationship with communities 16% (Prone).

For the present paper review, and per the consensus of the consulted experts, which is the standard of engineering in Colombia (Noguera, 2017) & (Icontec, 2011), the risk management response and action plans for each type of risk, is explained in Table 9.

This methodology to be used as guideline should be completed case by case, by using the proposed template for risk treatment plan included in the Annex 1. In column 4 of such Annex are suggested some risk responses that might be used and complemented with what are suggested in Table 9.

CONCLUSION AND RECOMMENDATIONS

Adequate risk management will provide high chances of increasing the perdurability of the organizations involved in SHPP projects. Risk management helps to achieve the main objectives of these organizations, to improve their self-knowledge, to improve productivity and ensure efficiency and effectiveness at productive processes. It will allow defining strategies for continuous improvement and definition of actions to be taken in the face of unexpected events or situations in which there is high uncertainty.

Results achieved can be used to feed algorithms of artificial intelligence such as fuzzy controllers or neural networks that will allow organizations interested in generation power projects, especially for Non-Conventional Renewable Energy Sources (NCRES); to develop automatic programs of Risk Management (RM).

For technical risks, it is important to bear in mind that because of economies of scale (EOS) (Arias-Gaviria, van der Zwaan, Kober, & Arango Aramburo, 2017), (Morales et al., 2015), the use of turbines

Table 9. Proposal of risk response

Type of risk	Risk response
Technical	Design and implementation of both: a policy and a contingency plan that makes it possible to reduce to the minimal the possibility of: a) producing a generated power with an efficiency different from the required. b) Incorrectly assume issues related to the connection point by the network operator. c) overpass budgets by assuming: amounts of work, prices or terms.
Financial and Commercial	Increase knowledge of financial variables and minimize uncertainty. Reduce risk by monthly monitoring of all variables. Use Monte Carlo simulations or Artificial Neural Network (ANN) to make quantitative assessments of levels of exposure to financial risks
Political, ethical and legal	Ensure full knowledge of the conditions agreed in the contract, to determine the positive or negative impact on the project balance of regulatory changes. Establish Training programs for all staff at all organizational levels in a culture of zero tolerance to compliance and ethical issues.
Organizational	Be prepared by succession plans, to assume the changes of strategic personnel and leadership style that are usual in the projects of SHPPs.
Environmental	To transfer the risk through the contracting of environmental consultancies that are responsible for the achievement of environmental permits, projection of documents and material management thereof, monitoring possible changes in environmental policies and legislation and the execution of environmental plan and obligations.
Relationship with communities	Accompany the socialization of the project with the study of social cartography and mapping. Define the Areas of Direct Influence (ADI) and the Area of Indirect Influence (AII). Increase the channels of communication to get more in touch with the communities

and generators manufactured in series for different flows and heights is increasing. These solutions are usually cheaper than those implemented with equipment tailored to the particular characteristics of the project. The efficiency of power generated and delivered power must be considered. Likewise, in Colombia it should be considered at an early stage the connection point by the network operator. It can cause high costs to get a distribution network to deliver the generated power. Most of the experts consider this as a concern.

For financial risks, it is recommended to use techniques and models such as Monte Carlo simulations (Arnold & Yildiz, 2015) or Artificial Neural Network (ANN) to make quantitative assessments of levels of exposure to financial risks (Sánchez et al., 2014), (Dagoumas et al., 2017). This is to increase knowledge of all variables and minimize uncertainty. It is frequent in Colombia that from the feasibility and financial closure stages until the implementation of the project, can take one or two years, even when stakeholders try to manage financial risk through public-private partnerships. Therefore, an update of the study of financial risk variables at the time of project start is advised. For example, the minimum selling price of energy is a fundamental calculation that determines the zero point, that is, the selling price where it is not lost or profit value with the operation of the SHPP and that can easily change during two years for elements such as: demand, fees, service, rights, non-payment, credit evasion; which lead to a lower cash flow than expected.

Most experts agree on that for organizational and leadership issues, programs and processes, must exist and function independently of people; changes of leaders and strategic personnel are common in SHPP projects. Depending on the stage of the project, the leader and leadership style required may change. In the SHPPs sector, project planning must be strengthened to operate successfully regardless of the type of leadership. It is precisely for this reason that a methodology for risk management adds value in the way in which SHPP projects are developed in Colombia.

Although both the electricity sector and the Colombian market are highly regulated, in the Wholesale Energy Market, SHPPs (no dam) are always dispatched, a monthly update of the financial risk variables is necessary, whenever market conditions change substantially. For example, the case of the near entrance of the hydroelectric plant Ituango (2,456 MW), without even entering to operate, already caused that they did not make auctions for reliability in the 2016.

Consultations prior to the communities are of great importance for the development of energy infrastructure projects and particularly for SHPP projects not only in Colombia but throughout all the world (Wüstenhagen et al., 2007). Although the socialization of the project is an obligation for licensing, social cartography and mapping is not usually evaluated, which is a serious error. This does not allow to know to the investors of the project, the initial social conditions of the zone of the project. Therefore, management does not have social baseline. This common mistake brings many problems when conducting land rights and fees negotiation, which defines community compensation and relocation activities. Social cartography and mapping allows the project manager to have a baseline and a detailed diagnosis of the social composition of the Area of Direct Influence (ADI) and Area of Indirect Influence (AII), which mitigates the risk of population increase at the time of implementing the project. It is common for many people to move to areas where projects will be built to try to get compensated. It is the social cartography in the ADIs and the AIIs for power generation projects in Colombia an issue that most experts found as a point of interest for future research studies. Increasing the channels of communication to get more in touch with the communities is also big concern between the experts.

The opinion of many of the specialists consulted agree that the enormous dynamics in environmental issues and the lack of legal security in Colombia have caused the non-viability of projects of

SHPPs, which is why foreign investors are advised by local consultancy firms who have experience in handling environmental legislation issues and even in relationship to communities. Future researches on environmental risks for SHPP should contemplate even location aspects as suggested in (Ioannidou & O'Hanley, 2018)

The impact on the public image of the organization that develops the SHPP projects is slight, if it is a standalone project (isolated), but when it is a project developed by an economic group or a large company in the market, the impact is medium or becomes severe, this because the blow in the indicators of reputation and brand positioning. In the latter case, it is highly recommended that the communications plan be also handled by local specialists.

Future researches on risk management for projects that use other sources of energy such as photovoltaic, wind and geothermal will be a new field of study in Colombia. It should contemplate the global experience in opportunities, barriers and related issues (Sen & Ganguly, 2017) in developing renewable energy projects. On the same way, looking for case studies that evaluate this and oncoming methodologies will be useful for community, academy and renewable power industry.

Under the guidance of Colombian Technical Standard (Icontec, 2011), a methodological proposal has been developed for risk management in SHPP projects in Colombia, which includes: identification of the main risk variables; qualification; quantification; evaluation and response to these risk variables. A methodological reference for risk management that improves the development of SHPP projects, has been provided.

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KEY TERMS AND DEFINITIONS

COLCIENCIAS: Administrative Department of Science, Technology and Innovation of Colombia. It promotes the policies to foster R&D in Colombia.

CORPOEMA: It is a Colombian initiative to promote energy efficiency and the sustainable use of natural resources in all economic activities.

DNP: Planning National Agency in Colombia is an agency within the Government of Colombia in charge of defining, recommending and promoting public and economic planning.

Environmental Crises: an ecological emergency, disaster or calamity that occurs when changes to the conditions of a species or population destabilizes its continued survival.

Fossil Fuels: buried combustible geologic deposits of organic materials, formed from decayed plants and animals that have been converted to crude oil, coal, natural gas, or heavy oils by exposure to heat and pressure in the earth's crust over hundreds of millions of years.

Global Warming: is the long-term rise in the average temperature of the planet Earth's climate system. It has been demonstrated by direct temperature measurements.

Greenhouse Effect: is a warming of Earth's surface and the air above it. It is caused by gases in the air that trap energy from the Sun. These heat-trapping gases are called greenhouse gases. The most common greenhouse gases are water vapor, carbon dioxide, and methane.

ICONTEC: Colombian Institute of Technical Standards and Certification is a non-profit private Colombian organization member of the International Organization for Standardization ISO that oversees the compliance of national and international standards.

IDEAM: Institute of Hydrology, Meteorology and Environmental Studies of Colombia is a government agency of the Ministry of Environment and Sustainable Development of Colombia. It is in charge of producing and managing the scientific and technical information on the environment of Colombia.

IRENA: International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international cooperation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy.

LEY 1715 of 2014: Colombian law that regulates NCRES. This law promotes the development and use of non-conventional energy sources (especially those from renewable sources), in the national energy system.

NCRES: Non-Conventional Renewable Energy Sources also known as new renewable energy sources (wind, biomass, geothermal, solar and SHPPs). FNCE for its acronym in Spanish.

NTC5254: Colombian technical standard for risk management.

Phenomenon of "El Niño": is a weather phenomenon caused when warm water from the western Pacific Ocean flows eastward. In South America, there is a drastic increase in the risk of flooding on the western coast, while there is an increase in the risk of droughts on parts of the eastern coast.

Renewable Energy: is a method of energy production that does not exhaust resources for its energy generation because it uses resources that can be renewed continually. I.E: geothermal, wind, solar, biomass and Hydrogeneration

SEN: National Energy System of Colombia.

SHPP: Small Hydro Power Plant refers to hydroelectric power plants below 10MW installed capacity by gravitational force of falling or flowing water without a dam: PCHs for its acronym in Spanish.

SIN: National Interconnected System of Colombia. The electricity supply in Colombia is based on the National Interconnected System (SIN) and several isolated local systems in the non-interconnected areas (ZNI). The Sin system comprises one third of the territory, which provides coverage to 96 percent of the population.

Sustainable Energy: is a mindset of energy production without putting in danger natural resources getting them expired or depleted and can be used over and over again. It does not include any sources that are derived from fossil fuels or waste products.

UPME: Mining and Energy Planning Unit of Colombia is the special administrative/technical unit responsible for the sustainable development of the country's mining and energy sector. It is Dependent on the Ministry of Mines and Energy.

APPENDIX

Table 10. Proposed template to be used as risk treatment plan

Risk Identification			Risk Evaluation			Risk Control					
Risk Prioritization Number RPN=Severity X Likelihood ($<100\%$) Table 10 (Columns 5&6)	Process or Work Activity	Risk (To be taken from Table 7)	Existing Risk Control (Examples)	Likelihood or Probability (To be taken from Table 7)	Impact or Severity (To be taken from Table 7)	Additional Risk Control Measures (Examples)	Severity After Control Measure	Likelihood After Control Measure	Risk Prioritization Number RPN = Severity X Likelihood ($<100\%$)	Follow up by (name) & date	Remarks
			Verification and compliance audits								
			Contractual conditions								
			Review and approval of designs and specifications								
			Inspection, audit and control processes			Contingency plans					
			Investment Portfolio Management			Contractual Addenda					
			Preventive Maintenance			Modifications in Design, Engineering and Specifications					
			Quality assurance, management and standardization			Continence and disaster recovery plans					
			Research and technological development			Structural and engineering barriers					
			Training and training			Communication Plans					
			Supervision								
			Tests and simulations								
			Organizational arrangements								
			Control Techniques								

Chapter 10

Project-Based Organizations: Project Manager Challenges at the Interface With the Customer

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ABSTRACT

Project-based organizations coordinate their activities using projects. These projects act as temporary and almost independent organizations that directly interlace the project-based organization with their customers. This complex interface is characterized by the existence of divergent interests between the two organizations. Therefore, project managers become crucial agents to handle this interface in order to accomplish the project's goals. By analyzing the retrospective accounts of twenty-four project managers, this chapter found that the project managers' actions that fostered the establishment of a relationship of trust and collaboration with their customer can be divided into four dimensions: providing knowledge, contextualizing the project, keeping the information flow, and boundary spanning. The authors argue that these project managers' actions and the generation of interaction spaces with the customer have an important impact on the development and success of the project.

INTRODUCTION

Over the last decades projects have been recognized as excellent endeavors to execute the organization's business activities to face fast-changing market environments (Bredillet, Tywoniak, & Dwivedula, 2015; Geraldi et al., 2008; Loufrani-Fedida & Missonier, 2015). Projects are 'temporary organizational forms' (Bakker, 2010, p. 466) that amalgamate the competences of different specialists in order to achieve a specific task, normally constrained by cost and time (Sydow, Lindkvist, & DeFillippi, 2004). Therefore, these temporary organizational settings have been taken as the units, or 'Lego' bricks, to build what research has coined 'project-based organizations'.

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Project-based organizations are “organizations that privilege projects to coordinate and integrate all their activities in their organizational structure” (Söderlund, 2015, p. 75) and are characteristic of different industry settings, as for example consulting and professional services such as engineering, accounting, finance and law, just to name a few of them (Bakker, 2010; Sydow et al., 2004). This type of organization allows these industries to face customers with extremely differentiated demands (Hobday, 2000; Sydow et al., 2004). Moreover, they permit deploying an intensive interaction at the interface of the project-based organization and the customer, which is crucial for the success of the firm. This interface is immersed in divergent interests coming from both organizations, and project managers play a crucial role to assure the correct development of the project. However, little is known about how they facilitate this process (Webber, 2008).

Project management literature has deeply studied the required competences of project managers (Ahsan, Ho, & Khan, 2013; Brière, Proulx, Flores, & Laporte, 2015; Edum-Fotwe & McCaffer, 2000; Fisher, 2011; Loufrani-Fedida & Missonier, 2015). Some authors argue that these managers, in order to handle the challenges at the interface with the customer, have to deploy their competences to generate an environment of trust and collaboration (Meng & Boyd, 2017; Pinto, Slevin, & English, 2009; Webber, 2008; Webber & Klimoski, 2004; Wong, Cheung, Yiu, & Pang, 2008). Notwithstanding, there is a need to shed light on how project managers handle building this environment of trust and collaboration throughout their day-to-day actions. Therefore, this chapter, by analyzing the retrospective accounts of twenty-four project managers working for project-based organizations in the Colombian territory, aims to answer the following research question: Which are the project managers’ actions that enable the establishment of a relationship of trust and collaboration with their customer? By delving into the actions of project managers at the interface with the customer, this exploratory work offers a richer understanding of the complex phenomena of the relationships between the project managers and the customers and the impact of these relationships on the project development.

The chapter is organised as follows: It begins by reviewing what it is known about project managers’ competences and their link with intra- and inter-organizations’ relationships. It then analyses the problematic of the interface between the project-based organization and the customer. Next, the research setting is described, followed by the presentation of the results, i.e. the project managers’ actions that enable the creation of an environment of trust and collaboration. Following, it discusses these results and presents future research directions. The chapter concludes by identifying the managerial implications.

PROJECT MANAGERS AT THE CORE OF PROJECT-BASED ORGANIZATIONS

Project-based organizations coordinate all their activities using projects (Söderlund, 2015, p. 75). These projects act as temporary and almost independent organizations that directly interlace the project-based organizations with their customers, that hold extremely differentiated demands (Hobday, 2000; Sydow et al., 2004). Therefore, the success of project-based organizations depends highly on ‘decentralized’ work of different teams and on the actions of project managers that lead these teams (Sydow et al., 2004). Consequently, the project manager and project manager’s actions are at the core of the organization’s success (Loufrani-Fedida & Missonier, 2015). For the achievement of the project’s goals, these managers need to deploy individual competences that typically Project Management literature classifies as technical competences, management competences and human competences (Ahsan et al., 2013; Brière et al., 2015; Loufrani-Fedida & Missonier, 2015).

Project Managers' Competences

First, technical competences are the specific knowledge managers need to have concerning methods, processes, and procedures related to the field where the project is developed (Ahsan et al., 2013; Edum-Fotwe & McCaffer, 2000; El-Sabaa, 2001) in order to propose and execute a valid technological solution to their customers (Loufrani-Fedida & Missonier, 2015; Muzio, Fisher, Thomas, & Peters, 2007). This type of knowledge allows the project manager to clearly identify the project's objectives and balance the divergent demands of quality, scope, cost and time (Ahsan et al., 2013).

Second, management competences allow managers to allocate and control the project's resources (Loufrani-Fedida & Missonier, 2015) in order to meet deadlines and budget (Brière et al., 2015). These competences encompass skills such as work organization, human resource management, and financial control (Ahsan et al., 2013; Brière et al., 2015; Loufrani-Fedida & Missonier, 2015). These management competences should also enable the manager to acquire a global vision of the project, recognizing how the different parts of the project interact between them affecting the success of the entire project (El-Sabaa, 2001).

Finally, human competences include several individual's traits and interpersonal skills. It is noteworthy that technical and management competences are called hard skills and in contrast, human competences are currently named soft skills. As individual traits it can be named: adaptability to the project context (Brière et al., 2015), ability to manage high stress levels (Brière et al., 2015; Fisher, 2011; Gruden & Stare, 2018), ethical responsibility and credibility (Brière et al., 2015; Skulmoski & Hartman, 2009), ability to exercise mentoring toward their team (Gruden & Stare, 2018; Loufrani-Fedida & Missonier, 2015), ability to learn from the project and their project team (Gruden & Stare, 2018), and personal accountability (Muzio et al., 2007). Interpersonal skills involve mainly skills that relate the project managers' interactions with their team. For example, it can be listed: the ability to communicate (Ahsan et al., 2013; Brière et al., 2015; Skulmoski & Hartman, 2009), leading others (El-Sabaa, 2001; Fisher, 2011), influencing others (Ahsan et al., 2013; Fisher, 2011), managing conflict (Fisher, 2011), and building trust (El-Sabaa, 2001; Fisher, 2011; Swärd, 2016).

These technical, management, and human competences, described as crucial for project managers, recognize the project mainly as an isolated and independent entity. Notwithstanding, no project works as an island (Bakker, 2010), on the contrary, projects are always immersed in their own organization and also in their global environment. In their global environment project managers have to interact with different stakeholders. Importantly, they will be at the interface with other organizations such as customers, suppliers, and regulatory entities. Project managers thus need to deploy and adapt these competences to cope with intra-organizational relationships and inter-organizational relationships (Meng & Boyd, 2017). The adaptation of these competences for the management of the different stakeholders interface is critical not only for the success of the project but also for the success of the project-based organization itself.

Project Managers' Competences Linked to Intra- and Inter-Organizational Relationships

On the one hand, according to Meng and Boyd (2017), project managers' intra-organizational relationships involve creating channels of communication with their team, developing trust among the project team, encouraging open dialogue between members, and actively working on the project activities. However, intra-organizational relationships include not only the project managers' interactions with their team but

also the interactions with the rest of the organization, e.g. other projects, human resources department, financial department, controllers, project management office, top management, etc. The interactions with the rest of the organization are normally framed in a constant tension between the necessity of project autonomy and the necessity of the project-based organization to control the processes, coordinate and integrate different ongoing projects, and assure the knowledge transfer among projects and all the while gradually improving project procedures (Sydow et al., 2004). Therefore, it is up to the project manager to mediate this tension for the success of the project and of the organization.

On the other hand, project managers' inter-organizational relationships include developing trust with external stakeholders, fostering communication with external stakeholders, recognizing and addressing problems at different interfaces, establishing long-term relations with customers and suppliers (Mazur & Pisarski, 2015; Meng & Boyd, 2017). Interestingly, Meng and Boyd (2017) argue that intra-organizational relationships may have a higher impact on project constraints (time, budget, scope and quality), however inter-organizational relationships impact directly onto customer satisfaction and therefore on the strategic goals of the project-based organization. That is why they argue that normally project managers pay more attention to the internal environment, jeopardizing thus the long-term success of the firm. A crucial inter-organizational relationship, that is scarcely studied, is the one that connects the project, and consequently the project-based organization, with the project's customer. Project-based organizations allow an intensive interaction at this interface that directly impacts the success of the project and that of the organization. At this interface, the project managers are the visible link between their organizations and their customers and it is up to them to conciliate two different organizational cultures that more than often are immersed in complex environments.

Project Managers at the Interface with the Customer

The interface between the project-based organization and the customer is embedded in the divergent interests coming from both organizations (Bakker, DeFillippi, Schwab, & Sydow, 2016; van Marrewijk, Ybema, Smits, Clegg, & Pitsis, 2016) that frequently lead to "highly unstable and complex, potentially conflict-ridden contexts for collaboration" (van Marrewijk et al., 2016, p. 1746). For example, the customer changes in its preferences or in the scope of the project are demands that the project manager has to conciliate with its project constraints of costs and time and with the internal demands from their organization (Bryde & Robinson, 2005; Ligthart, Oerlemans, & Noorderhaven, 2016). To palliate these problems, project-based organizations ask their project managers to build relationships of trust with their customers (Brière et al., 2015; Kadefors, 2004; Manu, Ankrah, Chinyio, & Proverbs, 2015; Sariola & Martinsuo, 2016; Webber, 2008; Wong et al., 2008). Inter-organizational trust is defined "as the expectation that alleviates the fear that a partner will act opportunistically" (Webber & Klimoski, 2004, p. 999). The development of trust between the two organizations is considered as a critical component to build a collaborative environment between the project-based organization and its customer during projects (Pinto et al., 2009; Webber, 2008). This inter-organizational trust is considered as multidimensional and can be decomposed into system-based, cognition-based, and affect-based (Webber, 2008; Wong et al., 2008). System-based trust is related to the system or structure built in place by the project manager to manage the project (Wong et al., 2008); for example, the clarity and the precision of the contract, the effectiveness of the structure of communication. Cognition-based trust is the customer's belief about "the project manager's reliability, dependability, and competence" in managerial and technical components of the project (Webber, 2008, p. 74). Finally, affect-based trust relates to the project manager's emotional bond

to the customer; for example, the demonstration that the project manager cares about the development and results of the project (Webber, 2008; Webber & Klimoski, 2004; Wong et al., 2008). Therefore, the project manager is at the core for the development of this inter-organizational trust. However, little is known about how these project managers succeed in creating these links of trust during the development of the project in their day-to-day activities. In this section the authors have analyzed the project manager's competences for the project's success; however, by deploying these competences: Which are the project managers' actions that enable the establishment of a relationship of trust and collaboration with their customer? This is the question that this explorative work aims to answer.

RESEARCH SETTING

To study project managers' actions that support the building of an environment of trust and collaboration at the interface project-customer, the authors have used a qualitative approach based on retrospective interviews (Søderberg, 2006). As argued by Mantere (2008, p.164), individuals are "the best source of information when inquiry is made on the character and motivations for their activity." The interviews followed a retrospective 'storytelling' approach letting the interviewees interpret the questions and focus on the points that they considered relevant. Soderberg (2006) considers the retrospective interview as a temporal arrangement in which the narrator orders and prioritizes some events and actors over others, thus providing an explanation that is plausible and reliable according to an interpretive perspective.

For this study, the authors interviewed twenty-four experienced project managers working for project-based organizations. The retrospective interview focused on their experiences lived during the most important project that they managed in the last two years. During the interviews the authors asked the informants to describe the actions and interpretations concerning their interactions with the customer from their first encounters, before or during the contract preparation, until the project closing. All the interviews were recorded and transcribed and most of them had a duration of around 40 minutes. The transcriptions were kept in the original language (Spanish).

The sampling was purposeful, trying to find project managers who had rich and varied lived experiences, i.e. heterogeneity (Patton, 2002). Project managers interviewed for this study belonged to different project-based organizations operating in the Colombian territory. These organizations belong to different business domains: construction, information technology, oilfield services, professional services, and public service. All studied projects took place in Colombia and had a duration that expands from 1 month up to 54 months (18 months on average). Table 1 informs the contextual information for each project manager interviewed and the project used to recount their experience: the business domain of their project-based organization, the customer's activity sector, the project duration, and a brief description of the project. In all cases, the informant's identity and their company remained anonymous. Throughout the next chapter, the authors informed for each quote the interview number from which it was extracted in order to show the diversity of the data used. However, these interview numbers have no rapport with the order of the projects shown in Table 1. This is to reinforce the anonymity conditions of the informants.

The unit of analysis was the project managers' actions and interpretations that linked them to the customer along the duration of the project. By positioning the unit of analysis at the individual level, this work focuses on project managers' actions leaving the project context in the background. Therefore, to analyze the raw data we undertook the following path. First, the authors read all the interviews to be acquainted with the informants on their narrative. Second, once they had a better understanding of the

phenomenon, the authors proceeded to codify the raw data looking for quotes describing the informants' actions and interpretations related to their interactions with the customer (Gioia, Corley, & Hamilton, 2013). To do so, the authors kept in mind the project managers' competences described in the literature (Eisenhardt, 1989) paying close attention to finding project managers' actions that could emerge during the process that support the establishment of a relationship of trust and collaboration with the customer. Therefore, the authors found that independently of the activity sector, project managers were performing twelve actions (see Table 2) that could be aggregated in four dimensions: providing knowledge, contextualizing the project, keeping the information flow, and boundary spanning. The next section describes these findings.

PROJECT MANAGERS' ACTIONS FOR THE GENERATION OF AN ENVIRONMENT OF TRUST AT THE INTERFACE WITH THE CUSTOMER

During the entire lifespan of a project, project managers draw upon their technical, managerial and human competences to perform actions that allow them to create an environment of trust with their customers. In our explorative work, through the narrative accounts of project managers, the authors found that to achieve this goal, project managers carry out distinctive actions that combine the different components of trust formation: system-based, cognition-based, and affect-based trust (Webber, 2008; Wong et al., 2008). These distinctive actions can be grouped in four dimensions: providing knowledge, contextualizing the project, keeping the information flow, and boundary spanning. Table 2 shows the distinctive actions that make up these four dimensions. Following, this chapter presents each one of these dimensions and describes the actions that they encompass.

Providing Knowledge

From the accounts of project managers, the authors found that providing knowledge was pivotal for the creation of a trust environment. By providing knowledge, they become a technical and a managerial reference to the customer. Project managers were providing knowledge when performing three types of actions: adding value to the project, participating in contract preparation, and controlling the project development. Following, these three actions are described.

Adding value to the project. According to the interviewed project managers, a key point for the development of a relationship of trust is the demonstration that the project manager can add technical and managerial value to the project. The project manager must have experience in the domain of the project, for example they have to exhibit through their actions during the interactions with the customer's managers that they have specific knowledge related to the project content and knowledge about the processes where the project's deliverables are going to contribute to the customer's organization. Moreover, they have to demonstrate that they are capable of managing the different project constraints and that they can serve as a link between the customer and the project-based organization, and between the customer and other stakeholders such as subcontractors and governmental entities. As one project manager claimed:

Much of the work revolves around the relationship with the customer: providing the technological advice required, being assertive, precise and effective in communications. I have to become the representative of my organization with the customer. This means that I have to become through the deployment of soft

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Table 1. Contextual information regarding the projects managed by the interviewed project managers

Business domain of the project-based organization	Customer's activity sector (project duration)	Project description
Construction	Wholesale (52 months)	Construction of a shopping center for wholesale vendors. The project aimed at the construction of a multi-level space with more than three hundred premises that would provide the appropriate adjustments for the sale of clothing and footwear in large volumes.
Information technology	Footwear (14 months)	Implementation of a unified information system for production control and distribution system. This project focused on the modernization of the production system of a medium-size company, connecting production, warehouses and points of sale.
Information technology	Communication services (24 months)	Development of technological support to the operation of a client in the communication sector. The project focused on the development of software tailored to meet the needs of the customer to provide services to its users.
Information technology	Financial services (24 months)	Modernization of the technological infrastructure for the administration of a central repository of securities. This project focused on replacing an obsolete transaction system with a new system that would provide better flexibility, functionality and security.
Information technology	Healthcare services (24 months)	Development of software to support the operations of a healthcare provider. The project was carried out to gather the information of the reports required from the customer by the regulatory entities.
Information technology	Communication services (24 months)	Implementation of a technological platform for the operation of a new virtual mobile operator through the integration of telecommunications services with application development services.
Oilfield services	Oil and gas production (14 months)	Implementation of a voice and data transmission system in real time to improve the performance of the well drilling process.
Professional services	Financial services (4 months)	Restructuring of a Project Management Office (PMO) of a multinational organization with presence in Latin America. The project sought to establish institutional mechanisms to improve the success rates of the projects.
Professional services	Food industry (6 months)	Determination of process improvements in a food production facility. The project comprised of an evaluation of the actual system and the proposal of alternatives to optimize the production system.
Professional services	Pharmaceutical industry (18 months)	Design and implementation of a biomedical registry that would allow the follow-up of a cohort of patients that was prescribed a specific medication for the treatment of a pathology. This project aimed to evaluate the effects of the medication during a period of to assess its effectiveness.
Professional services	Public service (18 months)	Structuring a tax reform that would allow the modernization of the tax code. This project aimed to improve tax collection by adjusting the rates applied to goods and services and strengthening the collection mechanisms of the portfolio.
Professional services	Public service (18 months)	Development and implementation of a national campaign to prevent child and adolescent pregnancy. This project is a response to a public health strategy from the Colombian government.
Professional services	Financial services (6 months)	Evaluation and valuation of the benefits of the merger of two firms from the same sector. The project aimed to assess the possible synergies acquired by strengthening the presence of the merged firm in this geographical area.
Professional services	Information technology (12 months)	Implementation of project management practices in a medium-size company dedicated to the development of software. The project's final goal was to qualify for international certification in project management.
Professional services	Food industry (54 months)	Design and construction of an artisanal craft beer production facility. The project comprised of the production facility, the process equipment, the product formulation and the production start-up.
Professional services	Public service (12 months)	Administrative and financial restructuring of an organization in the environmental management sector. The project consisted of the diagnosis and implementation of measures that would allow overcoming the financial losses reported by the organization because of its operations.
Professional services	Agroindustry (1 month)	Expansion of private agricultural exports with views of supporting the Colombian Government's growth strategy. This project aimed to take advantage of the commercial agreement between Colombia and Ecuador to export food.
Professional services	Public service (12 months)	Design of a strategy of knowledge management and strategic planning in a public organization. The project was developed as part of the continuous improvement goals of the organization to adequately meet the requirements of its stakeholders.
Professional services	Public service (18 months)	Development of an educational program for the government whose target audience was the teachers of preschool level. The project focused on strengthening the teaching competences to children under the age of five.
Professional services	Education (12 months)	Design of a strategic development plan for a private higher education institution. The project aimed to integrate the stakeholders' expectations in the construction of a joint vision for the institution's development.
Professional services	Oil and gas production (12 months)	Implementation of a risk management system for the hydrocarbon transportation service. The project considered the identification, evaluation and treatment of risks associated with the different operations of the organization.
Professional services	Information technology (18 months)	Implementation of the integration process for the merger of two companies in the telecommunications sector. The project was formulated to integrate the structures, processes and technologies of the two organizations.
Public service	Public service (36 months)	Acquisition of vehicles for difficult access areas. In this project it was considered for analysis the vehicle alternatives available in the market and the technical and functional requirements.
Public service	Public service (12 months)	Formulation of public policies for small and medium enterprises in terms of (SMEs) digital transformation. The project was focused on investing public resources into developing initiatives to foster the digital transformation of SMEs organizations.

Table 2. Project managers' actions for the generation of an environment of trust at the interface with the customer

Providing knowledge	Contextualizing the project	Keeping the information flow	Boundary spanning
• Adding value to the project • Participating on the contract preparation • Controlling the project development	• Generating an understanding of the customer • Facing customer-related challenges • Building ties with customer's managers	• Being the communication node • Keeping the customer informed • Bridging toward internal stakeholders	• Helping the customer's project appropriation • Building long-term relationships with the customer • Contributing to the customers' growth strategy

and hard skills, leadership competences, effective communication, conceptual and analytical thinking, the channel of communication for all the needs they have. (Interview 7)

Therefore, the project manager has to become for the customer a reference both in the technical field and in the managerial field. As Dainty et al. (2005) argue, the project manager must have the ability to see the 'bigger picture,' they have to be able to integrate the technical and managerial aspects of the project with the contextual factors of the punctual project. Consequently, they need to closely connect to the areas of expertise that support the execution of the project (Brière et al., 2015) and in this way add value to the project.

Participating on the contract preparation. From project managers' accounts, it can be easily identified that a thoughtful preparation of the contract sets the basis for the possibility of a collaborative work between both organizations. All interviewed project managers have reported their participation in this task in different ways. For example, some of them reported being part of the first encounters with the customer to delineate the document as it is shown in the following quote:

The first thing that was done with the customer was to clearly state what was going to be done. Establish our duty really clear. We also have to make clear the objectives that we were aiming with the project and at the same time to contrast these objectives with those of the customer, crucially, they needed to be aligned. And we listened, an important activity at the beginning was to listen to all the parties, but particularly to the customer. (Interview 17)

Interestingly, even if this stage may be perceived as a technical and systematic task, this manager highlights that the contract must also incorporate human factors when the project affects "process, people, egos, and organizational structures" inside the customer's organization.

Some others project managers participated in providing knowledge during the design and the writing of the technical part of the document as they were key to defining the activities and all their parameters to achieve the goals of the project required by the customer.

I reviewed the contract, established deadlines, calculated the number of hours, defined deliverables, and defined the criteria to measure the work and to evaluate the cost. The addition of all this information to the contract was crucial. (Interview 6)

However, as they noted, they also become a control agent of the entire document. This activity not only boosts their awareness of the project but also allows them to start thinking about the risks of the

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project and the difficulties that they may have to overcome during the project execution and foreseeing ways to solve them. Moreover, the preparation of the contract is one of the first activities that engages the project manager with the customer and it is the first arena where the project manager can show their commitment to understanding and accomplishing the expectations of the customer (Bryde & Robinson, 2005). The contract preparation phase must be embedded in a fluid dialogue between the project manager and the customers' managers. This permits them to start the project with clear and consensual conditions as to the scope of the project and the required schedule. This way it will serve as the main tool to control the development of the project.

It was key the definition in clear terms of what the client wanted and what we were willing to offer in the project. Be clear about the assumptions and the objectives. Working through these two points helped both of us. At the end, the objectives were developed conjointly, between the team that developed the project and the customer. (Interview 12)

Controlling the project development. The contract with the customer that should comprise the scope, schedule and customer requirements becomes the main reference for the project manager to control the project and it lies at the heart of the generation of system-based trust:

For me the project manager has a direct obligation to the contract and the main responsibility is to read and understand it in all its aspects. In my opinion, that is the document that validates precisely the commercial relationship between the customer and the company I represent. Therefore, the first thing I take into account is the contract and its implications, both operational and managerial. (Interview 4)

During the execution, the comprehensive knowledge of the contract that includes variables such as project scope and project schedule amalgamated with the knowledge of the project's context enables the project manager to exert control of the project. Moreover, according to the interviewed project managers this control can also be used as a space for dialogue with the customer. Control tasks should not be limited to the control of the deliverables but also to understand how the customer perceives the process.

I work daily in the follow-up of the activities that were defined in the project. I check if we are in the correct path through periodic evaluations and meetings with the customer, at the same time it allows me to perceive how they feel about the process. (Interview 9)

This way, the project manager becomes a real 'traffic light' for the project execution not only inside the project team but also at the interface with the customer. The activities to control the project development also become an important space for interaction with the customer fostering the development of trust. Project managers should use all possible opportunities to engage the customer in project-related tasks (Dainty, Cheng, & Moore, 2005). For example, this project manager designed conjoint control activities to increase the engagement of the senior managers with the customer:

We established a series of key control points, so that senior management would find out how we were doing with the project, if we were going well, if we were going badly, if we needed more resources. (Interview 2)

Contextualizing the Project

For project managers, it is paramount to master the context of the project in order to gain the customer's trust. To be intimately linked to the project environment that is predominantly the customer's organization, the authors found them performing three different actions: generating an understanding of the customer, facing customer-related challenges, and building ties with customer's managers. Following these actions are explored.

Generating an understanding of the customer. For the project managers from our sample, it was crucial, initially during the development of the contract and along the entire execution of the project, to understand the business and organizational context of the customer. As one of them said: "the first thing to do to be able to set up the project is to understand the customer." For them not only it is crucial to understand the business where the deliverables of the project will be implanted, but also, they are interested to know the structure of the customer's organization and to meet and understand the people that would have an important influence on the project. For example, in the following quote, a project manager reveals his approach toward his first interactions with the customer:

When I first sat down with them, for me it was important to learn about them, to discuss and discover their business vision, which were their expectations and, of course, to introduce myself as a person and as a professional. (Interview 4)

For these project managers, the success of the project is directly related to their understanding of the customer. This understanding only comes from a fluid interaction between the project manager and the managers of the customer. As one of them said about the stage of project design:

All the conversations with the customer's managers were an important contribution to the design of this project. We were making propositions about the deliverables and they were saying: not, that can't be done... and they were explaining why that was not possible inside their business model. They guided us throughout their entire processes. (Interview 2)

All these interactions allow the project manager to build an 'awareness of customer' (Daintly et al, 2005) that means the understanding of the formal structure of the customer's organization and its relationships of power, but also the informal structures that can become important constraints or enablers for the project. As Daintly et al. (2005, p.46) assert, an effective project manager 'uses this knowledge to address any underlying problems, exploit available opportunities, or mitigate political forces that can affect [the project]'.

Facing customer-related challenges. This awareness of the customer permits the project manager to navigate the organizational structure of the customer to solve the challenges that might appear during the execution stage. During the execution of the project, the project manager must mediate between the technical problems brought by the project and the customer's political and organizational challenges. To do this, project managers not only need to understand the formal and informal customer's organization but also need to understand through the eyes of the customer which are the benefits that the project brings to them, as one of the interviewee said: "You must understand what the project could bring to the customer at that particular moment."

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Once in the execution phase, during the day-to-day work and as they continuously develop their knowledge of the customer, project managers are able to better justify divergences from the contract requested by the customer's managers.

It comes from the day-to-day with the customer, then in the follow-up committees we analyse not only the deliverables, but also what the customer has been saying, what the customers have been thinking, which novelties we have found... This permit us to put ourselves permanently in the client's shoes to anticipate any eventuality and be able to react appropriately and surprise the client with the right solution, I believe that this is the most important, identify situations in which we can surprise the customer with the appropriate solution. (Interview 19)

This better understanding does not mean to abandon which was specified in the contract, on the contrary, a better knowledge of the customer allows the project manager to propose and negotiate solutions that can benefit both organizations when there are divergences from the contract. For example, project managers report receiving often requests from customers to add changes to the scope that might delay the project triggering stipulated penalties under the contract which goes against the interest of the project-based organization. However, the building of this customer's awareness gives the project manager the tools to work on the flexibilization of the scope while at the same time negotiating the withdrawal of the stipulated penalties. In addition, the understanding of the customers' context enables the project manager to better mediate between the project team and the customers' managers. Interestingly, the achievement of a collaboration mode between the project manager and the customers' managers has a positive impact on the cohesion and performance inside the project team (Webber, 2008).

Building ties with customer managers. One of the components of the generation of inter-organizational trust is the creation of an emotional bond with the customer (Webber, 2008; Webber & Klimoski, 2004; Wong et al., 2008). As one of the project managers reports regarding his interaction with the customer: "when you are involved in this type of work, it's really interesting because it touches your human side as you are always interacting with the customer." For the project managers, the customer is not an abstract entity, but a group of managers from the customer's organization that interacts with them on an almost daily basis. So, for project managers the generation of spaces to interact with the customer's managers becomes crucial. The following quote explains the importance of follow-up meetings:

The follow-up meetings were key to maintaining a good relationship with the customer. During these meetings we were able to discuss the difficulties and the divergences in our positions and arrive to solutions. (Interview 13)

Moreover, project managers stressed the importance of "generating empathy with the customer's managers." Many of them were required by the project conditions to spend time outside the project with these customers' managers which allow them to even generate friendship ties. For example, in the case of a communication system implementation in an offshore platform:

On the offshore platforms, you are practically in a jail, a very beautiful jail, and when the customer's managers are on the platform and also you as the project manager, it is easy to established friendship ties in the common spaces, then the customer becomes more of a friend, this confinement contributes to creating a relationship of friendship with these managers. (Interview 5)

Some others highlighted the importance of spending time outside the project to know these managers more at personal level:

It is important for me to generate spaces to spend time [with the customer's managers], such as meals or visits to tourist places. This can generate the creation of greater confidence between the teams. In my projects, I manage to spend time with them, not only at work, but also in spaces outside work. (Interview 13)

Most of the interviewed project managers agree that “projects are carried out by people and spending time together in non-workspaces allows them to know people beyond work and generate trust.” These ties with the managers of the customers help the project managers to better navigate inside the customer organization, to generate “transparent, open and cordial” communications, and importantly reinforce the development of the customer’s awareness that allows the project manager to contextualize the project.

Keeping the Information Flow

As the nexus between the project-based organization and the customers, project managers need to maintain the flow of information between both organizations. To do so they perform three types of actions: being the communication node, keeping the customer informed, and bridging toward internal stakeholders. As it is described below these actions are crucial to developing and maintaining a relationship of trust with the customer.

Being the communication node. In all the studied cases the project manager was the visible face of the project in the customer’s organization. Moreover, all of them understood that they were the veritable representative of the project-based organization for the customer. In the following quote one of them explains this crucial role:

I was the person who was in contact with the customer and with the project team members who performed the operational tasks. The communication was constant and face-to-face, telephone, e-mail. (Interview 11)

However, it is interesting to note that the project manager also becomes the visible face of the customer in the project-based organization’s land. From the first encounters, the project manager has to maintain a bidirectional flow of information. In the front end of the project, during the design, an important task of the project manager is to listen to the customer and transfer all the customers’ requirements to the project-based organization, but at the same time the project manager needs to warn the customer of all the challenges and risks that the project might face when following these requirements. Later, during the project implementation, the project manager has to inform the customer of the project development but at the same time, the project manager has to be alert to any changes in the customer’s organization that can impact the project and they have to maintain their own organization informed. In the following quote a project manager from our sample explains this latter point:

I believe that having a direct communication with the customer and constantly informing them about the activities, give us the possibility to receive an important feedback on the execution of the project allowing us to make decisions at the right time: corrections or additions. This way we will not jeopardize the relationship with the client nor the quality of the execution. (Interview 19)

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Therefore, the project manager is not only the person in charge of the communication with the customer, but importantly they become a crucial nexus between both organizations. Being at the center of this bidirectional flow of information, the project manager becomes the guardian of maintaining the relationship of trust with the customer.

Keeping the customer informed. The interviewed project managers believe that a constant communication with the customer and informing them about the development of the project is crucial not only for the creation of a relationship of trust and collaboration but also for the success of the project. This information is conveyed through formal and informal channels. Formal channels, normally, are weekly meetings as stated in the following quote:

We performed weekly meetings of two to three hours where we were communicating the activities, the progress, the performance, the value added, and the obstacles. In addition, we were analysing how those obstacles can be avoided or minimized. (Interview 7)

Another formal communication channel is the meetings related to the control points already stated in the contract. Weekly and control point meetings normally involve the middle management and senior management of the customer's organization. As seen, these meetings allow them to explain the development of the project, explain possible deviance, and reach consensus on possible solutions. These communications have to be open and honest to positively impact the success of the project (Manu et al., 2015; Wong et al., 2008).

Notwithstanding, most of the project managers from our sample highlighted the importance of the informal communication channels. These informal channels are embedded in the day-to-day work and reach not only managers but also operation people from the customer. Even if the salient goal of this informal communication is to keep the customer informed at all its levels about the project, this permanent interaction also allows the project managers to gather important information for the development of the project. This, importantly, reinforces the trust relationship with the customer as the project managers are better positioned to provide richer solutions and are demonstrating their interest in the development of the project at all levels of the organization. Following, we share the vision of one of the project managers concerning this point:

The contact is permanent, and the operational and tactical communication flows all the time. They have indeed the knowledge of their business and if we as providers, we can learn more about their business, we can add more value by going beyond the technical aspects. When we understand the real benefits of what we are offering, we can add much more value from the provider's point of view. (Interview 7)

Bridging toward internal stakeholders. Projects have internal stakeholders such as the members of the project teams or the managers and operative people of subcontractors. According to the interviewed project managers, one important task for them was to keep these stakeholders aligned with their strategy to approach the customer. On the one hand, project managers reported being the bridge between their team and the customer by exerting all the coordination of their activities and by overseeing their interactions with the customer's personnel to "avoid any conflict that can damage the relationship built." On the other hand, they also have to coordinate all the subcontractors' work and try to "avoid playing broken telephone with the customer." In the same way the project manager needs to gain the trust of the

customer, they need to work to gain the confidence of the subcontractors in order to “recruit them as allies to solve the problem of the customer” and reinforce the customer’s trust.

Boundary Spanning

All project managers in our sample evidenced acting as boundary spanning agents or individuals that through their actions alter the boundaries at the interface of two organizations (Balogun, Gleadle, Hailey, & Willmott, 2005). Related to this, we found project managers performing three actions: helping the customer’s project appropriation, building long-term relationships, and contributing to the customer’s growth strategy. By performing these actions, project managers are in some way expanding their mandate and entering into the borders of the customer organization. Notwithstanding, these actions positively impact the relationship of trust with the customer.

Helping the customer’s project appropriation. Most interviewed project managers believed that it is important from the beginning of the project to involve the customer at all its levels in the development of the project. These project managers feel that it is one of their tasks to catalyze the project’s buy-in on the customer’s organization. Therefore, they invest lot of effort in convincing managers from the customer that do not recognize the value of the project for their organization; they have to get across the objectives of the project and demonstrate the benefits. This customer buy-in and consequent appropriation of the project allows the project managers to gain the commitment from the customers’ managers as to time and resources allocated to the project. This task is not easy as it is explained in the following quote:

The customer’s organization had resources already committed to other projects in progress, then when my project began to demand more resources, I started requesting more resources and they had to review the allocation of resources. [...] I told them that if the resources requested were not allocated they would lose the benefits of the project. Nevertheless to obtain the resources was a hard path where I have to socialize a lot, to communicate a lot, and to show, based on the indicators of the project, the results that were being obtained. These were tough situations because it was not easy, but at the end, they assigned us the resources that we needed. (Interview 15)

Nevertheless, their efforts put in to convince go beyond customers’ managers. Often project managers have to reach the customer’s floor people if they want their project to succeed. Most of the time, operators see the project as a threat to their positions. Therefore, project managers need to gain also their confidence and convince them that the project implementation not only will affect positively their work but that they will also benefit from the project. In the following quote, a project manager implementing an information technology project explains this situation and his effort to revert it and gain the collaboration of these operational level workers:

Many [operators] thought that they were going to lose their jobs because of the software that we were implementing; all this was generating lot of anxiety. Therefore, the first thing we did was to target all those groups, especially in the factories, not in the sales points. Then we were saying: listen, you will be able to do more, you will still have your job here, and we will help you to go through the change. Therefore, that frontal attack, breaking that barrier, was significant, because removing those preconceptions made that people to start collaborating with the project. (Interview 2)

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Therefore, for the success of the project, project managers thus need to help the customer's organization to take ownership of the project. Project managers' work goes further than working only with their project teams on the tasks of implementation or control of a deliverable. Importantly, for the success of these tasks they have to expand the boundaries of the project and work with the customer's organization at all its levels.

Building long-term relationships with the customer. By working intimately and intensely with their customers, project managers build a relation with the customer's people that goes beyond the focal project. Interestingly, project managers that stressed the importance of building long-term relationships also recognised the existence of divergent opinions with the customer that are only solved through dialogue and with honest exchanges. This is exemplified in the following quote:

The relationship with the customer was built in more than ten years based on experiences, telling them the truth, and as project managers we have never looked for excuses and have prepared plans B, C and D so that they were always aware of what was happening. (Interview 5)

Project managers reported that trust is the essence of these long-term relationships and that this trust is built upon fluid communication and honest exchanges. Importantly, they understand that they are the key agent for the development of customer's feeling that the project-based organization cares about the project and their business.

Throughout the entire project, we as project managers have to make the customer feel that we are committed to the development of the project and truly perceive that the project is important for us. (Interview 11)

Most project managers in our sample also understand that the relationship with the customer should reach a higher level than the focal project itself. Moreover, bringing the relationship to that level is pivotal for the success of the project-based organization.

Contributing to the customers' growth strategy. Some project managers go further than the creation of an enduring relationship with the customer and they aim to contribute to the growth of the customer's organization. During the project they have reached an important understanding of the customer's organization that combined with the knowledge base of their organization place them in an interesting position to propose new projects and to support the development desired by the customer.

In some cases, when I see business opportunities, opportunities that link both organizations for the development of new projects, I bring forward my business skills, and I try to show that our company has the skills to work on these new projects and, of course, I try to increase the points of collaboration between my company and the customer. (Interview 4)

Therefore, the project managers that know how to navigate the customer's organization and processes are boundary-spanning agents that enable the project-based organization to offer new businesses that might contribute to the strategic growth of both organizations.

PROJECT MANAGERS AT THE INTERFACE WITH THE CUSTOMER

Projects are far from being an island (Bakker, 2010), on the contrary, projects are immersed in environments where the customer also exerts a lead role. Therefore, managing the interface between the project-based organization and the customer acquires a *sine qua non* importance. This interface is unstable and complex and it is characterized by the existence of divergent interests between the project-based organization and the customer (Bakker et al., 2016; van Marrewijk et al., 2016). Consequently, project managers have to navigate the troubled waters of the interface while conciliating the interests of these two organizations. Not only they have to balance the divergent demands of quality, scope, cost, and time internal to their projects, but also, they have to face the continuous demands from their customers. To cope with these demands, project managers need to create an environment of trust and collaboration with their customers. In this chapter, analysing the accounts of twenty-four experienced project managers, the authors found four sets of actions that enable project managers to build this environment of trust that were named: providing knowledge, contextualizing the project, keeping the information flow, and boundary spanning.

To set the foundation of a relationship of trust, project managers have to demonstrate by providing their knowledge that they have the hard skills to manage the project. Therefore, they deploy these skills from the first encounters with the customer and throughout the execution of their projects which helps to develop system and cognitive trust (Webber, 2008; Wong et al., 2008). By providing knowledge, project managers establish a dialogue with the customer that is vital for the development of the project (Bryde & Robinson, 2005; Dainty et al., 2005). Early on the preparation of the contract and later during the execution and monitoring of activities, the project manager is able to generate spaces for interaction with managers from the customer. These spaces are important to engage the customer in the project-related tasks (Dainty et al., 2005) and also to access to customers' contextual knowledge (Maurer, 2010).

Contextualizing the project allows the project manager to build an 'awareness of the customer,' i.e. a comprehensive knowledge of the customer's context which includes their formal and informal organizational structures, their business and their business environment. The understanding of the power relationships in the customer's organization allows project managers to better navigate the structure of the customer as they can recognize tacit constraints for the development of the project (Dainty et al., 2005). The understanding of the customer's business and their environment enables project managers to provide better solutions to reach the project goals. They are able to adapt to the customer's reality and to develop ad hoc answers to the focal project challenges (Brière et al., 2015). This 'customer's awareness' also helps project managers to get closer to their colleagues inside the customer organization which reinforces the creation of stronger ties of trust. These emotional bonds (Webber, 2008) boost the generation of formal and informal interaction spaces which enables project managers to better grasp the needs and capabilities of their colleagues (Wong et al., 2008) and to create an environment of collaboration (Kadefors, 2004; Sariola & Martinsuo, 2016).

Project managers are the veritable representative of the project-based organization in the customers' field and they fulfill this position by keeping the information flow between the two organizations. Communication between both organizations has to be open and honest to foster information exchange between individuals (Manu et al., 2015; Wong et al., 2008). Importantly, this information flow that has at its center the project manager is bidirectional, because by maintaining the customer up to date on the project activities, project managers can receive important cues about the perceptions of the customer employees concerning the project. These cues are important to evaluate the development of the project and in turn to keep the project-based organization informed about the status and necessities of the project,

which are directly related with the customer needs. Therefore, project managers become ambassadors of the customer in their own organizations. Information flows not only through formal channels directed to the top and middle management of the customer's organization but also through informal channels that also reach the operation levels of the customer. Moreover, these interactions at lower levels can be seen as a sign of good will by the customer's organization (Swärd, 2016). In a nutshell, by interacting with all the levels of the customer's organization, project managers are able to gather crucial information for the development of the project and to enhance the creation of a collaborative environment.

Project managers might become crucial boundary spanning agents in the interface with the customer. By their actions they can permeate inside the customer's organization favoring the development of the project and the creation of stronger ties with the customer. On the one hand, project managers that reach all the levels of the organization are better positioned to help the customers' employees to embrace and take ownership of the project, tasks that impact positively on the success of the project. All of this represents hard work to generate interaction spaces at all levels of the organization in order to communicate the benefits of the project and to transfer the knowledge that will prepare customers' employees to understand its benefits. On the other hand, project managers that have developed a 'customer awareness' and that have worked intimately and closely with the customer managers can 'spread the word' about the project-based organization (Webber, 2008; Webber & Klimoski, 2004). They are able to better understand the underlying needs of customers (Dainty et al., 2005), so they can cement the creation of a long-term relationship and even collaborate with proposals for the growth of the customer organization.

In a nutshell, projects allow the deployment of an intensive interaction at the interface between the project-based organization and the customer. Experienced project managers exploit these conditions to generate multiple interaction spaces, formal and informal, and at top, at middle, and at operative levels of the customer organization for the creation of relationships of trust and collaboration. The management of this interface becomes crucial for the success of the project. Meng and Boyd (2017) suggest that the management of this interface impacts mainly customer satisfaction and the strategic goals of the project-based organization. Notwithstanding, this chapter also demonstrates that the management of this interface and the generation of an environment of trust with the customer also have an important impact when it comes to balancing the divergent internal project constraints of time, budget, scope and quality. The combination of the project managers' actions that the authors describe in this chapter (see Table 2) germinate the creation of interaction spaces that serves to solve the divergences with the customer that can jeopardize the accomplishment of project goals. The engagement of the project managers in these interaction spaces enables them to see the 'bigger picture' (Dainty et al., 2005; El-Sabaa, 2001) which allows them to face the challenges of the project at the interface with the customer and to generate ties with the customer that can impact the growth strategy of the project-based organization.

FUTURE RESEARCH DIRECTIONS

The management of the interface with the customer is mainly seen as crucial to satisfy the strategic goals of the project-based organization (Bryde & Robinson, 2005; Kadefors, 2004; Meng & Boyd, 2017). However, more research should address how the management of this interface, at the agent level and adopting a practice (Jarzabkowski, Balogun, & Seidl, 2007; Whittington, 2006) and processual (Burgelman et al., 2018; Langley, Smallman, Tsoukas, & Van de Ven, 2013) approach, impacts the development of the focal project. Moreover, future research should focus on how the constant tension in the project-

based organization between project autonomy and organization control (Sydow et al., 2004) impacts the management of the interface between the project-based organization and the customer.

The present chapter explores project managers' actions that impact the development of an environment of trust with the customer. However, it focuses on the two lead organizations: the project-based organization and the customer and its internal stakeholders. Nevertheless, there are external stakeholders that could affect the management of this interface. Therefore, future research should also study the impact of these external stakeholders on the management of this interface.

CONCLUSION

This chapter has sought to explore how project managers are able to create an environment of trust and collaboration at the interface of the project-based organization and the customer. Many works have revealed the competences and skills required by project managers to perform their duty (Ahsan et al., 2013; Brière et al., 2015; Fisher, 2011; Loufrani-Fedida & Missonier, 2015) such as technical, managerial and human competences. This chapter shows how, by combining these competences and skills, project managers create an environment of trust by performing four sets of actions that the authors named: providing knowledge, contextualizing the project, keeping the information flow and boundary spanning. These actions are the pillars for the creation of interaction spaces where project managers act as communication nodes. Importantly, they become the center of a bidirectional flow of communication; even if they feel their duty is being the face of the project-based organization on the customer's territory, they also become the ambassadors of the customer on their own land. Moreover, they act as boundary spanning agents to counteract the resistance of some customer's employees toward the project and to develop lasting ties with the customer. By exploring the agency of project managers at the interface between the project-based organization and the customer, the main contribution of this chapter has been to bring forth the impact that the actions of project managers can have on the generation of an environment of trust and collaboration, on the development of the project, and consequently on the project's success.

Managerial Implications

This research bears four implications for putting it into practice. First, project managers need to be involved in the interaction with the customer from the beginning of the project. Project managers' intervention during the pre-design and preparation of the contract becomes of paramount importance. A profound interaction and collaboration between the project manager and the customer's managers at this stage lay a solid basis for the development of a collaborative work environment for the rest of the project. Second, project managers need to engage in the understanding of the formal and informal relationships in the customer's organization and the comprehension of how the project deliverables align with the customer's processes. This knowledge grants the project manager the ability to navigate better the customer's organization and to provide richer solutions that can conciliate the interests of both organizations. Third, project managers should understand their nodal position in the interface between project-based organization and customer. Normally they embrace their formal positions as the visible face of the project-based organization in the customer. However, they also should commit to their informal role of being the customer representative on their own organization. By engaging in this dual role they become the driver for the establishment of a collaborative work; there is no other agent

that is better positioned to understand and conciliate the interests of both organizations. Fourth, for a better development and control of the project, project managers should interact with all levels of the customer's organization. Normally, project managers interact at higher levels, middle and top managers. However, to better understand the project and its challenges in the customers' land, project managers should also engage with operational levels. Project managers should not only control the development of the four project internal constraints, but also the buy-in of the project at all the organization levels of the customer. In the end, all these variables will have an impact on the project and it is up to the project manager to leverage them to reach the project goals.

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Chapter 11

Towards a Multidimensional Explanatory Approach to Voluntary Organizational Change

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ABSTRACT

At the theoretical level, several authors have modeled the progression of change, which has given rise to several explanatory processes of change (planned, political, interpretative, incremental, complex processes, etc.). Each process has particular change characteristics. The empirical results showed the coexistence and complementarity of several explanatory processes of change to explain the change observed in the projects planned by the senior management. In this descriptive chapter, we present a synthesis of the different characteristics of the explanatory processes of change as well as the empirical results of their confrontation in the field. The purpose of this chapter is to highlight the importance of the different characteristics of change that shift up over time. A consideration of this aspect will allow managers to better target the managerial actions to be implemented throughout the change process in order to succeed it.

INTRODUCTION

Starting in the 1960s, many researchers have tried to explain organizational change. Their work gave rise to two explanatory approaches for change: the deterministic approach and the voluntarist approach.

According to the deterministic approach, change is imposed (Burns and Stalker, 1961; Woodward, 1965; Lawrence and Lorsch, 1967; Hannan and Freeman, 1977; Mintzberg, 1982). It represents an organization response to internal pressures or changes in the environment. This approach is criticized by cognitive school theorists because it attributes a passive and reductive role to business leaders (Reitter et al., 1991; Laroche, 1997).

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Criticism addressed to the determinist approach reveals a second research approach namely “the voluntarist approach”. The latter postulates that the choice to initiate or not a change depends on the will of the actors and their strategic choices (Bennis, 1969; Beckhard, 1975; Beer, 1976; French and Bell, 1978).

The theorists of deterministic and voluntarist approaches deal with the question: why does the company change? They explain the reasons of the organizational change. However, recent work addresses the question: how does the company change? They are interested in explaining the progression of change over time (Van de Ven and Poole, 1995). Several authors have modeled the progression of change, which has given rise to several explanatory processes of change (planned, political, interpretative, incremental, complex processes, etc.) (Van de Ven and Poole, 1995; Vas, 2005; Lengendre et al., 2006; Pichault, 2009). Each of these processes has particular characteristics of change.

In this context, several authors (Vas and Ingham, 2002; Beldi, 2004; Vas, 2005; Pichault, 2013; Sghari, 2013; Sghari et al., 2016) have raised a question: at the empirical level, is there a dominant explanatory process to understand and explain the observed change or can explanatory processes of change coexist to explain it? The reply to this question showed the coexistence and complementarity of several explanatory processes of change to explain the change observed in the projects planned by the senior management (Vas and Ingham, 2002; Beldi, 2004; Vas, 2005; Cicconi and Soparnot, 2010; Pichault, 2013; Sghari, 2013; 2016; Sghari et al., 2015; Sghari et al., 2016).

Given the high number of the cited researches, it is difficult for the reader to have a global and synthetic vision of the research work dealing with the management of organizational change. Thus, it would be very interesting to propose a researches summary dealing with organizational change in order to facilitate the comprehension of the theoretical basis of organizational change and consequently the management of organizational projects introducing changes. In this descriptive chapter, the authors present a synthesis of the different characteristics of the explanatory processes of change as well as the empirical results of their confrontation in the field.

THE PROCESS OF ORGANIZATIONAL CHANGE

Organizational change can be approached from three perspectives: content perspective, contextual perspective, and process perspective. The first one explores and explains change in terms of its impact on different components of the organization (Shirley, 1975). The second one focuses on forces or conditions existing in an organization’s external and internal environments (Pettigrew, 1985a; 1985b; Armenakis and Bedeian, 1999). According Pettigrew (1985a; 1985b), studies dealing with organizational change must take into consideration the context in which change is evolving. The third one, to which this study adheres, deals with temporal dynamics relating to the progression of change. In the latter perspective, change is considered as the passage from an initial, primary state to a secondary state which is empirically observed via differences in form, quality, or the state of the entity (individual work, group work, organizational strategies, programs, products, or entire organizations) through time (Van de Ven and Poole, 1995).

Several authors have modeled the progression of change according to the different explanatory processes of change presented in Table 1.

At the empirical level, is there a dominant explanatory process to understand and explain the observed change or can explanatory processes of change coexist to explain it? The answer to this question is discussed in the next section.

Towards a Multidimensional Explanatory Approach to Voluntary Organizational Change

Table 1. Explanatory processes of change

Explanatory processes of change	Description
Planned process	Change requires voluntary actions by actors who materialize through the use of planning for change (Kotter, 1995). Key features of planned change are: setting goals, setting deadlines, defining roles, and deploying change activities, tasks, and interventions (Pichault, 2013). Leaders coordinate and optimize decision making, decision implementation, and decision monitoring by mobilizing evaluation tools.
Political process	Change can lead to particular actors losing benefits, access, influence or power (Crozier and Friedberg, 1977). Faced with such disenfranchisement, these actors may resist changes decided upon by the senior management of the company. The process of change is not, therefore, free from confrontation, tension, and conflict (Biggart, 1977; Kanter <i>et al.</i> , 1992). Thus, change is characterized by power struggles and continuous bargaining between the interests of the various actors that are, in part, beyond the control of leaders (Harrison, 1985).
Interpretative process	Change is envisioned as a process of meaning creation. In this sense, actors play the role of “producer of meaning” by introducing and legitimizing new patterns of thought triggered by change (Pichault, 1993).
Incremental process	Change is a dynamic process influenced by the history and past experiences of the organization (Pettigrew <i>et al.</i> (2001). It's characterised by a proliferation of trial and error, emerging project modification along the way, etc. (Pichault, 2013). Two fundamental characteristics in this process (Pichault, 2013): - Dependence on previously developed choices; - The existence of several projects conducted in parallel within the organization: the incremental process helps explain the changes taking into account the impact of the conduct of several projects in parallel in terms of resource allocation.
Complex process	Change is insurmountably difficult to predict and control which leads to the appearance of unexpected phenomena which may or may not be a desirable relative to pre-change benchmarks.

TOWARDS A MULTIDIMENSIONAL EXPLANATORY APPROACH TO ORGANIZATIONAL CHANGE

Van de Ven and Poole (1995) are the first authors who recommended the study of the interaction of different explanatory processes of change in order to understand and explain change. Later, Pichault (2009) assumes that the explanation for change is based on the study of the tensions exerted by different explanatory approaches of change on the process of change.

Model of Van de Ven and Poole (1995)

According to Van de Ven and Poole (1995), there is a theoretical pluralism to explain change. Based on an analysis of interdisciplinary literature, they identify four process models that explain change, namely:

- Life-Cycle Theory;
- Teleological Theory;
- Dialectical Theory;
- Evolutionary Theory.

Explanation of the Four Processual Models of Change Identified by Van de Ven and Poole (1995)

Life-Cycle Theory is based essentially on work that deals with the organic growth. It explains the change as the progressive development of the organizational unit from the “initiation” phase to the “termination” phase. Teleological Theory explains the change by focusing on the study and the explanation of the purpose of the organizational unit development. Unlike the Life-Cycle Theory, Teleological Theory does not imply a logical and sequential approach to the progression of change. It rather emphasizes the importance of the necessary preconditions to achieve the end state. Teleological Theory mobilizes the contribution of the systemic approach to prove the existence of several possible behaviours to reach the final objective. Dialectical Theory explains the development of the organizational entity by the existence of a permanent dialectical tension between at least two entities. Each entity has its own identity that opposes or contradicts with the other. Finally, Evolutionary Theory is based essentially on the works dealing with biological evolution. The starting point is that a population of entities exists with limited resources. The development of the organizational entity is explained by the existence of identifiable mechanisms for the variation, selection and retention of entities in the population.

Life-cycle, teleology, dialectical, and evolutionary theories provide four internally consistent accounts of change processes in organizational entities which are summarized in Table 2.

Table 2. Theoretical currents of change processes of Van de Ven and Poole (1995)

Process models explaining change	Description
Life Cycle	Change is imminent: that is, the developing entity has within it an underlying form, logic, program, or code that regulates the process of change and moves the entity from a given point of departure towards a subsequent end that is prefigured in the present state. The typical progression of change events in a life-cycle model is a unitary sequence (it follows a single sequence of stages or phases), which is cumulative (characteristics acquired in earlier stages are retained in later stages) and conjunctive (the stages are related such that they derive from a common underlying process).
Teleology	Development of an organizational entity proceeds towards a goal or an end state. It is assumed that the entity is purposeful and adaptive by itself or in interaction with others. The entity constructs an envisioned end state, takes action to reach it, and monitors the progress. Thus, the development is envisaged as a repetitive sequence of goal formulation, implementation, evaluation, and modification of goals based on what was learned or intended by the entity.
Dialectic	Organizational entity exists in a pluralistic world of colliding events, forces, or contradictory values that compete with each other for domination and control. These oppositions may be internal to an organizational entity because it may have several conflicting goals or interest groups competing for priority. Also, oppositions may be external to the organizational entity as it pursues directions that collide with the direction of other organizations. Stability and change are explained by reference to the balance of power between opposing entities. Struggles and accommodations that maintain the status quo between oppositions produce stability. Change occurs when these opposing values, forces, or events gain sufficient power to confront and engage the status quo. In terms of organizational change, maintenance of the status quo represents stability, but its replacement by either the antithesis or the synthesis represents a change.
Evolution	Evolution is in a more restrictive sense to focus on cumulative changes in structural forms of populations of organizational entities across communities, industries. Change proceeds through a continuous cycle of variation, selection, and retention. Variations, the creations of novel forms of organizations, are often viewed to emerge by blind or random chance; they just happen. Selection of organization occurs principally through the competition for scarce resources, and the environment selects entities that best fit the resource base of an environmental niche. Retention involves forces (including inertia and persistence) that perpetuate and maintain certain organizational forms. Retention serves to counteract the self-reinforcing loop between variations and selection.

Towards a Multidimensional Explanatory Approach to Voluntary Organizational Change

Table 2 lists the various processual models of organizational change identified by Van de Ven and Poole (1995). This theoretical pluralism could lead to a partitioning of perspectives leading to isolated lines of research. In order to understand the progression of change, these authors argue in favor of mobilizing the interaction of these different process models that explain change.

Empirical Results of the Application of the Modeling of Van de Ven and Poole (1995)

In order to test the modeling of Van de Ven and Poole (1995), Beldi (2004) conducted a case study in a company of the telecommunications and information technology sector in France. This author studies the interaction of different process models that explain change throughout a change process in the context of a project of Customer Relationship Management (CRM). The results show the coexistence of different process models for the explanation of the observed change.

Table 3 presents the result of this study.

The life cycle model is of little relevance to characterize the two phases (adoption / adaptation and consolidation / evaluation). Indeed, several difficulties were encountered by the project team that can only be interpreted through the mobilization of teleological and dialectical models. Thus, the empirical results show the importance of the mobilization of different process models to understand change.

Van de Ven and Poole (1995) recommend explaining change by studying the interactions between different process models explanatory of change. In the same vein, Pichault (2009) states that explanatory processes exert tension on the process of change. This author recommends explaining change by studying these tensions.

Model of the Five Forces of Pichault (2009)

Pichault (2009) argues that the process of change is conditioned by the tensions exerted by change processes (planned, incremental, political, interpretative, and contingent).

Explanation of the Model of Pichault (2009)

Pichault (2009) illustrates his vision of explaining change by studying the tensions exerted by processes of change in his multidimensional model presented in Figure 1.

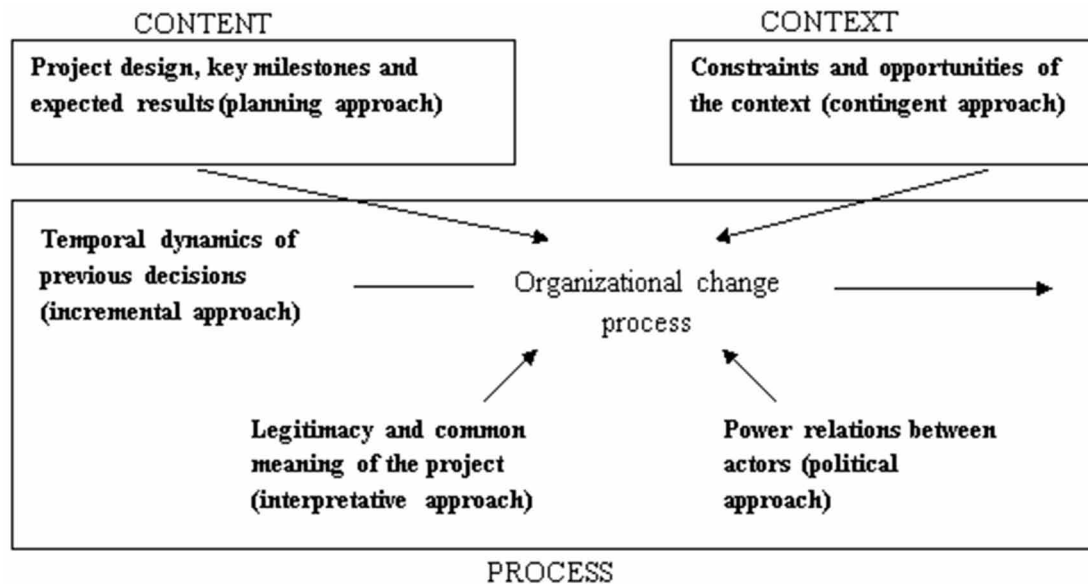
Pichault (2009) identifies five explanatory processes of change: planned, contingent, political, interpretative and incremental processes. The contingent process discusses the importance of taking into account the characteristics of the internal and external context of the environment. It explains change as a process of adaptation to the organizational context in order to align with the environment.

Table 3. Comprehensive meta-model of change processes (Beldi, 2004)

Phases of the project	Initiation	Adoption / Adaptation	Consolidation / Evaluation
Processual models of change	Planned process according to the life cycle model	Teleological model	Hybrid process Teleological / dialectical

Beldi (2004) finds that the process of organizational change is a complex and hybrid process.

Figure 1. Pichault's five forces model (2009)



According to Pichault's model (2009), change is always explained by contribution of these five explanatory processes of change.

Empirical Results of the Application of Pichault's Model (2009)

In order to test its modeling, Pichault (2009) examined four cases:

- Case of change in a public administration;
- case of change in a media group;
- case of change in an air cargo business;
- case of change in a news agency.

In the first three cases, the author accompanied the various projects by interviewing dozens of actors involved in change, observation and document analysis. In the fourth case, he used only documentary analysis over a period of 15 years.

The results show:

- No explanatory process of change allowed the explanation of the change observed in the first case
- The coexistence and complementarity of different explanatory processes of change for the explanation of the change observed in the last three cases

The change in Case 1 "Modernizing HRM in a Public Administration" has failed.

The evaluation of this case of change in relation to the four explanatory processes of change (planned, contingent, incremental, political and interpretative) shows that none of them can explain the observed

change. Such a result announces the limits of the explanatory power of the integrative model of Pichault (2009). Two remarks should be noted:

- In his model, Pichault (2009) did not integrate the contribution of chaos theory and the current research dealing with complexity in explaining change. This aspect has been treated and modeled by Vas and Jaspart (2010) and Graetz and Smith (2010) who propose the chaotic or complex process. The latter explains the result found by Pichault (2009) in case 1 “Modernization of HRM in a public administration.”
- The contingent process is concerned with the study of internal and external context factors that explain change within the organization. But, contextualization (case studies) reduces the importance of mobilizing this explanatory process. In addition, Soparnot (2004) reports that the “contingent process” helps to understand the causes and factors that drive the organization to change while its implications regarding the progression of change remain limited.

These two remarks raise the importance of mobilizing the complex process of understanding change and reducing the importance of taking into account the contingent process.

In addition to the work of Beldi (2004) and Pichault (2009), the authors present, in the following, other empirical results proving the coexistence of explanatory processes of change to explain and describe the observed change.

OTHER EMPIRICAL RESULTS

The empirical observations (conflicts between actors, different interpretations by the actors, adaptation to events encountered during the process of change, resistance to change, etc.) show the importance of the mobilization of the different explanatory processes of change in order to explain the reality of change (Andreeva, 2008).

Table 4 presents empirical results relating to the confrontation of the explanatory processes of change in the field.

In the first study, Vas (2005) mobilizes five explanatory processes of change (planned, political, routine¹, creating meaning² and chaotic³) in order to follow the course of the change process. Field observations allowed rejecting the existence of a single explanatory process in favour of a combination of processes that explain change.

In the second study, Andreeva (2008) studies the limits of the applicability of the planned model in the context of change programs in 59 Russian industrial firms. The results show that the changes have not proceeded according to the initial planning set by the leaders. This author shows the importance of mobilizing the contingent model in order to take into account the contextual characteristics of the companies studied in explaining change. In examining these results, the authors notice a separation between the two “hierarchical” and “organizational development” processes. These two processes are grouped together by several authors (Pichault 2009, Vas and Jaspart 2010, Graetz and Smith 2010) in the same conception of the “planned process”.

In the third study, Cicconi and Soparnot (2010) studied four change projects in a private higher education institution located in central France:

Table 4. Empirical results of studies relating to the confrontation of change processes in the field

Authors	Purpose of the study	Explanatory processes of change
Vas (2005)	Explaining the change observed in a reengineering project in a major European telecommunications company.	1st phase of process Content: Planned Process: Predominance of planned, and routine-cultural processes Context: Politics
		2nd phase of the process Content: Politics Process: Predominance of political and chaotic processes Context: Politics
		3rd phase of the process Content: Interpretative Process: Chaotic Context: Predominance of political and chaotic processes
Andreeva (2008)	Study the limits of the applicability of the planned process in change programs in 59 Russian industrial companies.	Planned and contingent processes.
Cicconi and Soparnot (2010)	Explaining the change observed in a merger project between two structures of higher education.	Hierarchical and organizational development processes.
	Explaining the change observed in a project of creating an online program.	Hierarchical and organizational development processes.
	Explaining the change observed as part of an accreditation process	Organizational development process.
	Explanation of the change observed in the context of a project to develop a Bac +3 schools.	Hierarchical and political processes.
Sghari (2013)	Explanation of the change observed in the context of a project to redesign the Information System in a bank.	1st phase of process Planned, political and interpretative processes
		2nd phase of the process Planned, political, interpretative and complex processes
		3rd phase of the process Interpretative, incremental and complex processes

- Merge with another structure of higher education;
- creation of an online program;
- accreditation process and;
- development of a Bac +3 school.

The authors mobilized five explanatory processes of change: hierarchical, organizational development, political, incremental and interpretative. They observed the coexistence of these different processes in explaining the same project of change.

Finally, Sghari (2013) mobilizes five explanatory processes of change (planned, political, interpretative, incremental and complex) in order to follow the process of change induced by a project to redesign IS in a leading Tunisian bank. Field observations have led to the rejection of the existence of a single explanatory process in favour of a combination of explanatory processes of change that differ from one phase to another of the change process.

CONCLUSION

The objective of this chapter is to present the explanatory processes of change that are developed to describe and explain the progression of change: planned process, political process, interpretative process, incremental process, and complex process. In order to understand and explain change, Van de Ven and Poole (1995) argue in favour of studying their interaction.

Examining the empirical results shows the coexistence and complementarity of these different explanatory processes to understand the observed change (Beldi, 2004; Vas, 2005; Pichaut, 2009; Cicconi and Soparnot, 2010; Sghari, 2013; 2016; Sghari et al., 2015; Sghari et al., 2016). These results show the importance of taking into consideration the different characteristics of change that shift up over time.

On the theoretical level, this descriptive chapter presents a summary of the work dealing with organizational change. It facilitates to the reader to understand the theoretical basis of organizational change and consequently the management of organizational projects introducing changes. On the empirical level, it is recommended to practitioners to better target the managerial actions to be implemented throughout the change process in order to succeed the organizational project.

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KEY TERMS AND DEFINITIONS

Complex Process of Change: change is marked by unexpected phenomena, stops and blocking.

Explanatory Process of Change: the modeling of the progression of change.

Interpretative Process of Change: change is marked by a consideration of the actors' perceptions.

Incremental Process of Change: change is marked by building on previously developed choice.

Planned Process of Change: change is marked by a succession of phases, monitoring of procedures and setting of objectives.

Political Process of Change: change is marked by power struggles and continuing negotiations between the interests of different stakeholders within the organization.

Voluntary Organizational Change: change decided and planned by the senior management of the company.

ENDNOTES

- ¹ The routine process envisages change as a process of choosing between different existing organizational routines and controlling how they evolve or remain stable over time (Vas, 2005). In this research, this aspect is taken into consideration by the incremental process.
- ² Interpretive process according to the terminology adopted in this research.
- ³ Complex process according to the terminology adopted in this research.

Chapter 12

Sustainability on Project Management: An Analysis of the Construction Industry in Colombia

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ABSTRACT

Ensuring the conservation of current resources for future generations has become a challenge that from day to day turns to be more important and urgent for society. Despite the fact that sustainability and project management have been subjects of interest in the academic community, few investigations are related to the integration of sustainability within project management, even fewer in the Colombian context. This empirical research work presents results about the perception from a representative sample of project managers from the construction industry in Colombia related to the implementation of elements of sustainability when managing projects established in the maturity model of Salem Azahrani. The results indicate, on one hand, a low average level of maturity and on the other, a higher orientation toward aspects of the economical dimension of the projects in comparison with the social and environmental dimensions.

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INTRODUCTION

The modern times, characterized by the demographic, industrial, and technological increase in a consuming society, have faced humanity with big problems related to the sustainability of the planet. Issues related to climate change, contamination from human, industrial, and transportation activities, low incomes for a greater number of inhabitants of the planet, and the constant and overwhelming increase of the population have generated an urgent need to implement global strategies focused on satisfying current needs without compromising the resources needed for future generations. This reality has been placing a growing interest on the sustainable development on top of mind of the world (Silvius et al, 2012). On the field of sustainable development, great and important challenges for countries had been placed, on the economic, social, and environmental dimensions seeking to inherit a better world for the generations to come (Pope, Annandale, & Morrison-Saunders, 2004).

Like in many other disciplines of knowledge, different theories and approaches have emerged in matters of sustainable development, nevertheless, one of the terms that is widely accepted by the academic community is the one that integrates the economic, environmental, and social dimensions known as the Triple-Bottom-Line (TBL) by John Elkington (Gimenez, Sierra, & Rodon, 2012). When studying concepts about sustainable development, there is also an approach that involves four perspectives: environmental, economic, ethic, and sustainable governance (Viso, 2005). Nonetheless, this last approach like others that have emerged in the study of sustainable development involved the model proposed by John Elkington in 1994 (Elkington, 2004; Martins, Mata, & Costa, 2006), Triple-Bottom-Line (TBL), which as shown in this chapter is also the foundation of the maturity models for sustainable project management.

Sustainable development has moved to all the aspects of public and organizations management, of course, project management is not the exception. Projects have traditionally been thought of as a unit of development, reason why it has been a growing matter of study focused on proposing and implementing bodies of knowledge and singular methodologies for project management. Currently, the study of projects has strengthened the approach that the standards and methodologies of project management are fundamental for the fulfillment of the global objectives of sustainable development (Aarseth *et al.*, 2017).

As a discipline, project management has gained spaces on the academic and organizational contexts due to the generalized acceptance of the benefits in the achievement of the objectives of the organization in the private and public sectors (Pinto, 2015). Important professional associations in this discipline have issued project management methodologies that are generally accepted (Errihani, Elfezazi, & Benhida, 2015). At the global level, projects participate widely on the distribution of the Gross Domestic Product (GDP) of nations and on scope; projects are present on the totality of human activities, reason why they are considered crucial in order to reach purposes of sustainable development (Schipper & Silvius, 2017).

Nowadays, sustainable project management has come to play a fundamental role both on the academic and the practical fields, it is so that besides the objectives of fulfilling projects in terms of scope, budget, and time, it is necessary to add sustainability as a project objective and as an additional element within the processes of project management (Gareis, Huemann, & Martinuzzi, 2013). However, it has been verified that the bodies of knowledge of project management, generally accepted, hardly consider in an explicit manner the techniques and tools to manage the life cycle of a project from the perspective of sustainability (Schipper & Silvius, 2014). Therefore, the integration of sustainability in the field of project management and the design of strategies, techniques, and associated tools to be implemented in the Project Management (PM), poses an important and current challenge for the discipline.

With the interest of approaching the study of techniques and tools that allow the integration of sustainability in the processes of project management, a CANVAS model has been developed for the planning of sustainable projects (Schipper & Silvius, 2017), whose generalized implementation is still to be validated. In this same direction, Martens and Carvalho (2017) identified four key factors for the integration of sustainability in project management through a factorial analysis: 1) business model of sustainable innovation, 2) stakeholder management, 3) economic and competitive advantage, and 4) environmental and resource saving policies. While for Kivilä, Martinsuo, and Vuorinen (2017) sustainable project management is implemented using a holistic control package in which the control mechanisms are used differently for different economic, environmental, and social dimensions of sustainability, which is complemented with the governance of the project, linking the project with its stakeholders and external regulations.

Likewise, Silvius and Schipper (2015) developed a practical tool that integrates and allows the evaluation of sustainability in the field of PM, called SPM3 for its acronym of Sustainability Project Management. The SPM3 is a prescriptive model that allows evaluating the maturity in the sustainability of projects, distinguishing four levels according to how the organization of the project directs its actions from the orientation of not harming towards making a positive contribution in the economic, environmental, and social dimensions. In order to establish the level of maturity on each of the 3 dimensions of sustainability of the TBL, the SPM3 model incorporated 22 indicators. Silvius and Schipper (2015) and Silvius and Simionescu (2016) applied the SPM3 model to measure the maturity of sustainability of the PM from the perspectives of the process and the product of the project.

On the other hand, in this same field of evaluating the maturity in sustainability of project management, we also have the work by Salem Alzahrani (2015). The model developed by Salem Alzahrani was used to assess the maturity of project management in Saudi Arabia. This model is also based on the dimensions of sustainable development (economic, social, and environmental of the TBL) and relates indicators of organizational culture of the projects. According to the self-assessment carried out by those responsible for the management of projects in organizations, allows locating each company in one of the five maturity levels that are established in the model. The greater the commitment of the organization on implementing policies, documented procedures, techniques, and tools of sustainable development in their projects, the greater its level of maturity. The model by Salem Alzahrani (2015) is the theoretical basis for the development of the work in this chapter, which is related to the construction sector in Colombia.

The construction sector in Colombia has been one of the main drivers of national economy growth, mainly due to the growing dynamics of projects and macro projects in civil works during the last three decades; this is how in 2018, the growth of the Gross Domestic Product was of 2.5% compared with the previous year, and the construction was one of the sectors that contributed the most to this growth (DANE, 2018). However, this growth in one of the elements of the economic dimension of the TBL has not generated benefits in the social dimension, judging by the results of recent studies related to the hiring system for construction employees, where there have been numerous irregularities in labor insertion processes in the sector that increase informality and subcontracting; frequently violating the employee's labor rights and increasing expenses both in the subcontracting of personnel and in the payment of legal sanctions caused by the mistakes in the contracting processes for the construction companies (González Valencia, 2017).

Finally, in the environmental dimension, the operations pertaining to the construction sector and other agents intervening directly or indirectly in the construction projects, cause important impacts on the environment related to the consumption of natural resources and energy and with the emission of

greenhouse gases, which is why methodologies have been proposed for the inclusion of indicators of “ecological footprint” and “carbon footprint” in the construction cost bases (Freire Guerrero, Muñoz Martín, & Marrero, 2016). Likewise, the study of construction projects management has been a subject of constant interest in the scientific literature due to its high rate of failure related to delays and cost overruns. In Colombia, the most important factors for this problem have been identified as inadequate planning and lack of integration among professionals (Lozano Serna et al., 2018).

The study included in this chapter, emerges as a need to integrate the subjects of sustainability with project management and the increasing importance of both subjects in the global context of the organizations and of the society in general. Likewise, for the particular case of Colombia, given the relevance and implications of construction projects in the economic, environmental, and social dimensions of the country, it is important to carry out research that contributes to improving the management of this type of projects. The objectives of the study are aimed at answering the research question: how are aspects of sustainability arranged in the model by Salem Alzahrani (2015), in the management of construction projects in Colombia, based on the perception of project managers? Answering this research question helps to fill a gap that has been identified in the integration of sustainability issues and project management in the scientific literature, especially in the Colombian context.

In this order of ideas, this research development is part of the non-experimental quantitative paradigm, because it uses data collection and statistical analysis to test hypotheses, establish patterns, and test theories (Hernández, Fernández, & Baptista, 2010). This study is exploratory, descriptive, and cross-sectional (Tamayo & Tamayo, 2003) because it includes the registration and interpretation of the way in which the purposes of sustainability in the management of construction projects in Colombia are intended to be achieved, for which a series of key variables that can describe this process are defined (Hernández, Fernández, & Baptista, 2010). For the purpose of comparing the results of this research with those obtained in other studies, the design of the methodology in this research is similar to that of studies with common characteristics in other areas, such as the ones by Silvius and Simionescu (2016), Silvius and Schipper (2015), and Salem Alzahrani (2015).

Electronic means were used in order to send and receive the questionnaires; a total of 392 were sent and only 73 were correctly completed and received, for a response rate of 18.6%, consistent with what is expected in this type of studies (Pagell et al., 2015). The size of the sample that was obtained is representative judging by the criteria and standards suggested by Spiegel and Stephens (2009). The tabulation and analysis of the data, both of the descriptive and the hypothesis tests type, is carried out in the statistical software R®. The project managers participating in the study evaluated on a Likert scale each of the indicators of the three dimensions of PM sustainability of the model by Salem Alzahrani (2015), according to the performance of their projects. The responses that were obtained were analyzed as scalar variables and verified by a univariate analysis for the demographic analysis of the sample, and another of the multivariate type to establish significant differences, using the ANOVA statistical procedure.

The results allow to conclude that according to the perception of managers of construction projects in Colombia, the management of this type of interventions is only at the lowest level of maturity of sustainability of the reference model, demonstrating that the organizations of these projects are mainly oriented to the economic dimension of the project, and to a lesser degree to comply with the rules and regulations on social and environmental issues related to the context and execution of their construction projects. In addition, the results indicate that the organizations that develop construction projects in Colombia are more oriented to the sustainability of the deliverables or the products of the projects that towards the sustainability of the management process of these projects. When analyzing the results of

the evaluation of maturity in the sustainability of projects according to the size of the company, it was found that there is no significant difference in the average levels of maturity in the economic perspective of the TPL. However, sufficient statistical evidence was found to establish that the average level of maturity in the social and environmental dimensions is lower in construction projects in medium and small companies than in large companies. These findings allow academics and PM practitioners in the construction sector to direct their efforts to propose PM strategies and tools aimed at improving environmental and social indicators of sustainability.

BACKGROUND

Sustainability is an issue that, due to great social pressures, is becoming increasingly relevant in the agendas of countries at a global level and of organizations at the local level (Figge & Hahn, 2004; Yanarella & Bartilow, 2000). At the global level, sustainable development has been a priority issue for the United Nations since 1927 and the concept has evolved to the one of “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”, evolving from clearly ecological aspects to include and link the economic, social, and environmental aspects that are the basis for the formulation of the Millennium Goals of the United Nations (Økland, 2015).

In the field of organizations, the tendency has to do with the formulation of strategies that involve the three-dimensional approach known as the “Triple Bottom Line” (TBL) proposed by Elkington in 1998 (Elkington, 1998). In this book, Elkington prompts companies to rethink in such a way that economic objectives such as adding value to shareholders necessarily include positive impacts on the social and environmental dimensions of the environment in which they operate. The Triple Bottom Line is also known as the Triple P, for the three elements of interest People, Planet, and Profit. Today, a large number of organizations formulate their mission and vision including the dimensions of the TBL (Weber, 2008) and integrate sustainability into their operational processes and actions (Peenstra & Silvius, 2017).

In the field of projects, the importance of the projects in the achievement of the millennium goals of the United Nations has been recognized, in part because the projects represent more than 30% of the Gross Domestic Product worldwide (Turner et al., 2010; Pinto, 2015). This implies that in order to guarantee the rational and efficient use of the resources that are currently available without endangering the development and satisfaction of the needs for future generations, it is essential to incorporate sustainable policies and practices in project management. It is argued that the relationship between projects and sustainability is very important, because projects play a vital role in the development of nations (Marcelino-Sádaba, Pérez-Ezcurdia, & González-Jaen, 2015).

In current times, the pressure for the adoption of sustainable policies and practices has penetrated all the activities of humanity. In the case of construction projects, these interests are greater because of their substantial impact on the environment (Hashemkhani Zolfani et al., 2018). Thus, methodologies such as the sustainable construction have been proposed, since it seeks to implement practices tending to reduce energy consumption and promoting the use of environmentally friendly materials, the reduction of emissions, the control of waste, and minimization of the impact in the environment in which the project operates (Staniunas et al., 2013). This chapter deals with the incorporation of sustainability in construction projects in the Colombian context, according to the perception of project managers.

Construction projects have been subject to social pressures aimed at requiring sustainable constructions that minimize the impact on the environment (Biswas, Wang, & Krishnamurti, 2008). These pres-

sure arise from the public knowledge that the energy and raw materials that are used in construction projects generate waste and emissions into the atmosphere that are potentially harmful to the population (Alnaser, Flanagan, & Alnaser, 2008). This has generated the emergence of the so-called sustainable architecture that is framed within two major challenges for humanity, such as sustainable development and the creation of smart cities (Hashemkhani Zolfani et al., 2018). However, the widespread acceptance of a sustainable construction practice is a difficult challenge to achieve (Guy & Farmer, 2001).

The turning point towards the concern for human impacts on the environment and its consequences on the long-term risk to human existence on the planet emerged in the 1960s and 1970s, opening the field to the concept of sustainable development (Singh et al., 2009). Although there is a wide variety of concepts related to sustainability, in fact, Aarseth, Ahola, Aaltonen, Økland, and Andersen (2017) reviewed more than a hundred definitions and concluded that most agree on the need to look for a balance in the economic, social, and environmental dimensions. In general, there is a concession among scholars of this field of sustainable development in which the definition must involve aspects such as the use of resources to meet the current needs of humanity, but also the obligation of rational and efficient use so as not to compromise the needs and the development of future generations (Aarseth et al., 2017).

The management of projects is also considered one of the disciplines with the greatest interest both in the academic field and in the practice, and in the public and private sectors (Golini, Kalchschmidt, & Landoni, 2015). Project management has become an essential element for the success of projects in all types of organizations, regardless of the industrial sector or the size of the project, and within that context, project management methodologies are seen as a means that can be applied to improve the probability of meeting project goals (Charvat, 2003; Milosevic & Patanakul, 2005). The adequate use of the different methodologies of project management confer advantages to the organizations that implement them, in comparison to those that do not, for example, the first ones are more clear about the objectives of their projects, they better identify the resources that are necessary for execution, ensure better accountability and results, and improve the achievement of project objectives (Turbit, 2005). The importance of project management and sustainability for the sustainable development of the planet is indisputable, therefore, it is a priority challenge to incorporate the dimensions of the TBL into the project management methodologies.

Despite the fact that in recent years there has been an increase in studies that document, justify, and propose ways to incorporate elements of sustainability into project management methodologies, there is a gap between what is suggested in the literature and what is carried out in practice (Økland, 2015; Peenstra & Silvius, 2017). When analyzing generally accepted bodies of knowledge in project management such as the Project Management Body of Knowledge (PMBOK), the PRINCE, ISO21500, and the ICB International Competence Baseline, it has been found that although they include issues related to the management style of those interested in the project, the elements of sustainability are mentioned as elements of the context of the project and in general, they are not mentioned explicitly (Eskeroed & Huemann, 2013; Økland, 2015). As per the ISO standards, there is the ISO26000 of Social Responsibility aimed at all types of organizations and touching on fundamental elements of the social dimension of the TBL, however, this rule is not directly related to the management of projects.

Sustainability in the field of projects and project management is not alien to this growing social pressure and interest, in fact, the studies that integrate sustainability in project management have grown exponentially since 2004 (Silvius & Schipper, 2014) and they are expected to increase over the next five years (Økland, 2015). Aarseth, Ahola, Aaltonen, Økland, and Andersen (2017) have located the first proposals to be included in the topic of sustainability in project management methodologies in two

Construction Management & Economics publications, the first by Hill & Bowen, published in 1997, and the second by Chen & Chambers, published in 1999. However, the academic discussion on the integration of the sustainability dimensions in projects has exploded from 2004 - 2006 (Aarseth *et al.*, 2017), until it is regarded that sustainability can be considered as a school of thought, that is new, different, and emergent in project management (Silvius, 2017)

The study of sustainable project management has been approached from multiple perspectives. For example, an exploratory study with the purpose of identifying facilitators for the integration of sustainability in the projects, from the suppliers point of view, was able to identify certain patterns: 1) the orientation to implement elements of sustainability in the event that the customer of the project requests it and is willing to pay for it; 2) the implementation of the elements of sustainability in the case of generating benefits and; 3) the orientation to implement elements of sustainability in the case that the customer of the project requests it and that it fits the strategy of the organization providing the project (Peenstra & Silvius, 2017). On the other hand, special relevance has been given to the implementation of a holistic control package in which different indicators are used in each of the three dimensions of the TBL, complemented with the sustainable governance of the project, and linking the external stakeholders in order to take advantage of innovation opportunities and, therefore, promoting economic, environmental, and social sustainability (Kivilä, Martinsuo, & Vuorinen, 2017).

Traditionally, the indicators of success of a project are related to the ability to meet the requirements of the interested parties, stay within the budget, and be delivered on time (Yazici, 2009). However, there are positions in between that claim the inclusion of sustainability within the key factors of project success, measured with indicators that are related to social, environmental, and economic indicators (Silvius & Schipper, 2010). This is to ensure that sustainability is consolidated within the practices of project management. In this regard, an empirical study has shown a significant and positive relationship between project sustainability management and the success of the project, and in the reduction of the negative social and environmental impact in the project environment (Carvalho & Rabechini Jr, 2017).

In this same direction, the study by Aarseth, Ahola, Aalton, Økland, & Andersen (2017) based on a systematic review of the literature has distinguished two trends in the field of the study of sustainability in the management of projects. On the one hand, it is the focus of the organization that delivers the results of the project, and on the other, it is the perspective of the organization that receives the product of the project. Table 1 summarizes the eight strategies that have been identified in relation to the integration of sustainability in the management of projects and in the management of organizations of the project (Aarseth *et al.*, 2017). Table 1 presents and describes the eight strategies that have been identified, including strategic aspects such as policies, objectives, and portfolio selection, aspects that are related to the integration of the groups of stakeholders of the project, the inclusion of sustainability in the early stages of the project and in the project practices, and the development of competencies related to sustainability in the members of the project team.

In the study of project management, the concept of maturity is addressed. Maturity in project management in organizations is related to the search for a competitive advantage in the market through excellence in projects (Backlund, Chronéer, & Sundqvist, 2014). The way to achieve this goal is best described through the maturity models in project management, which are composed of stages that relate the base and the necessary elements that must be satisfied for an organization to move from one level of maturity to the next one (Kerzner, 2008), the implementation of good project management practices, even for a long time, is a necessary but not sufficient condition for achieving excellence.

Table 1. Strategies for sustainability extracted from the literature review

Strategy	Description
Setting strategic and tactical sustainability goals	Focusing explicitly on sustainability issues when developing project strategies, paying special attention to instances where sustainability issues align with other concerns.
Developing sustainable supplier practices	Supporting suppliers in implementing sustainable practices such as the use of ecological materials and prefabrication.
Emphasizing sustainability in project design	Incorporating sustainability issues in early phases of projects and explicit project design documents. The methods are based on development of performance indicators (that may be used throughout the project life cycle) and appraisal techniques such as life-cycle assessments and value management.
Setting sustainability policies	Defining sustainable project policies, that include the development of laws and regulations, norms, plans, and guidelines to support sustainability at the project level, and executing governmental and regulatory tasks in a manner that it emphasizes and promotes sustainability in projects carried out in the host region.
Influencing sustainability of project practices	Supporting the incorporation of sustainability into project practices and technical systems by means of construction tools, prefabrication, and waste management systems.
Inclusion of sustainability-promoting actors in project organization	Selection and inclusion of actors that bring sustainability-promoting skills, capabilities, and roles to the project.
Sustainability-emphasis in project portfolio management	This relies on either using a framework for project selection or actively including sustainability as a dimension in early-phase appraisals.
Developing sustainability competencies	Expanding competencies and skill sets of project managers by investing in formal training programs.

Source: Aarseth et al. (2017)

Under this same approach, the models of maturity assume that the knowledge and experience of organizations can be translated into procedures, work plans, routines, and databases, which leads to the configuration of a collective brain that is integrated into the organizational culture (Gareis & Huemann, 2000). In general, management maturity models involve the structuring of processes and key areas in which capacities and practices are grouped and developed according to key performance indicators (Monteiro de Carvalho, Alves Patah, & de Souza Bido, 2015). Maturity models are structured according to levels of competence, processes or domains by analyzing their repeatability and continuous improvement. In this framework of search for excellence in the practice of project management in organizations, the issue of sustainability has become relevant in the last five years, in such a way that different models of maturity in the management of sustainability begin to emerge in project management.

Currently, there are several models of project management maturity, most of which have been developed by consulting firms (Foti, 2002). A good part of these models have been created during the last two decades, although some of them existed before, as for example, the Capability Maturity Model (CMM) and the Capability Maturity Model Integration (CMMI) (SEI, Software Engineering Institute, 2006), the Project Management Process Maturity Model (Ibbs & Kwak, 2000), the Project Management Maturity Model (Kerzner, 2001), the Organizational Model of Maturity in Project Management (PMI - Project Management Institute, 2013), and the Project Management Competence Model PM (Gareis & Huemann, 2000). Including the previous models, Grant and Pennypacker identified more than 30 models available in the market, some of them dedicated to specific sectors of the industry such as SPICE (Structure Process Improvement for Construction Enterprises) (Sarshar, Haigh, & Amaratunga, 2004). In general, the models of maturity in project management suffer from the integration of elements of the economic, social, and environmental dimensions of sustainable development, for this reason the proposals for

maturity models to manage the sustainability of the projects are in an incipient state and its widespread acceptance is to be checked.

This chapter deals with the maturity of sustainable project management. In relation to proposals for maturity models for managing the sustainability of projects, we can cite the SPM3 model by Silvius and Schipper (2015). This model allows to assess the maturity of sustainability management in project-oriented organizations, on a scale of four levels presented in Table 2. At the first level of maturity in the sustainability of project management of the SPM3 model, the organizations focus their activities to comply with the regulations related to sustainable development, that are valid in the context in which they operate. As the elements of sustainability permeate the strategic direction of the organization and are evident in the practice of project management, their level of maturity in SPM3 will be greater. In the SPM3 model by Silvius & Schipper (2015), the last level of maturity corresponds to the economic, social, and environmental dimensions that are included throughout the life cycle of the project. By advancing the levels of maturity of the SPM3 model, the organization moves from a reactive to a proactive vision, impacting in a positive way the sustainability of its environment.

In practice, in order to evaluate the level of maturity of an organization with the SPM3 model, a total of 22 indicators are considered, distributed in the three dimensions of the TBL. Silvius and Simionescu (2016) carry out an empirical study in Romania aimed at assessing the maturity of sustainability in project management from the perspective of the process and the product. The findings of this study allowed to identify greater orientation of the project toward the economic dimension and less towards the social dimension, and also a greater orientation toward the product than towards the processes of project management. Likewise, the participants in the study by Silvius and Simionescu (2016) in consensus expressed the utility model SPM3 for the holistic analysis of the management of sustainability of the project and for the identification of improvement opportunities.

We can also find the maturity model in the management of project sustainability developed by Salem Alzahrani (2015), which becomes the basis of the research that this chapter deals with. This model is aimed at evaluating the maturity in the management of economic, social, and environmental dimensions in project-oriented organizations. The model by Salem Alzahrani, (2015) distinguishes five levels of maturity as an organization implements policies, practices, techniques, and tools of sustainable development in its projects, and implements processes of continuous improvement to its level of maturity in the management of the sustainability of its projects. According to the work developed by Salem Alzahrani

Table 2. Levels of maturity on the management of sustainability for projects from the SPM3 model

Strategy	Level of maturity	Description
Not to harm Contribute positively.	Level 1: Compliance	This aspect of sustainability is considered minimalistic and empirical, and with the only intention of fulfill laws and regulations.
	Level 2: Reactive	This aspect of sustainability is explicitly considered with the intention of reducing the negative impacts of the project.
	Level 3: Proactive	This aspect of sustainability is explicitly considered as one of the areas where the project contributes.
	Level 4: Of purpose	Making a contribution to this aspect of sustainability is one of the fundamental factors for the project, and the considerations of sustainability are included into the project justifications.

Source. Silvius and Schipper (2015)

(2015) in Saudi Arabia, ensuring a better performance in the sustainability of projects requires the commitment of the decision makers in the organizations, project managers and all project stakeholders.

In order to validate the model by Salem Alzahrani (2015) to assess the maturity in the management of sustainability in the projects, an empirical study for project managers was developed in Saudi Arabia. The result of this study demonstrated a significant relationship between the management of the three dimensions of sustainable development in the projects (economic, social, and environmental) and the elements of the organizational culture of the project-oriented organizations. The model by Salem Alzahrani (2015) allows to identify strengths and critical points to improve, in order for project-oriented organizations to achieve higher performance in the practice of project management with a long-term vision and responsibility in each one of the three dimensions of sustainable development. This chapter focuses on the analysis of sustainability management in projects from the construction sector in the Colombian context and takes the maturity model by Salem Alzahrani (2015) as a reference.

MAIN FOCUS OF THE CHAPTER

The main focus of this chapter is to establish the current level of maturity in the sustainable management of construction projects for Colombia, and also to know the state of maturity in each of the economic, social, and environmental dimensions of sustainable development in project management of construction in the Colombian context. To this end, the project management maturity model, developed by Salem Alzahrani (2015) has been taken as a reference. This model allows project-oriented organizations to identify strengths and weaknesses in their project management approach in order to improve the sustainable vision of the projects, including the process of project management as the result of the project. As evidenced by the literature, the projects sector is made up of companies that are clearly project-oriented.

The model by Salem Alzahrani (2015) was validated through the application of a system of structural equations by means of the analysis of partial least squares and the analysis of variance ANOVA, in order to test the relationships among the components of the model. This model takes as main components the variables that are related to the three dimensions of sustainable development (economic, social, and environmental) and the organizational culture. Due to the fact that the Salem Alzahrani (2015) model was validated in the context of projects in Saudi Arabia, some adjustments were made to the original instrument in this study, in order to adapt it to the Colombian context.

The research development of this study is framed in the quantitative nonexperimental paradigm, because it uses data collection and statistical analysis to test hypotheses, establish patterns, and test theories (Hernández, Fernández, & Baptista, 2010). This is the reason why the variables derived from the objective of identifying strengths and weaknesses in the management of sustainable projects in the construction sector in Colombia were analyzed for the present study, in search of an approach to the linked facts and related to the context in which are presented.

This study is exploratory, descriptive, and cross-sectional (Tamayo, 2003) because it includes the registration and interpretation of the project management process in the construction sector in Colombia and its integration with the dimensions of sustainable development, for which a series of key variables that can describe such a process are defined (Hernández, Fernández, & Baptista, 2010). This indicates that, through the appreciation of the variables, the researcher can be clear about the fact on which the research was established and oriented. Likewise, the research is causal considering that it is intended to determine the influence of certain independent variables on other that is dependent, in this case, the

maturity in the management of sustainable projects (Ouellet, 2001). In order for the results of this research to be compared with those obtained in other studies, the design of the methodology is similar to that of studies with common characteristics in other latitudes, such as those of Salem Alzahrani (2015).

The population of this research is constituted by the total of directors of construction projects in Colombia and therefore of large size. Taking into account that the parameter to be estimated is a proportion and that previous studies are not considered, it is therefore necessary to use a random sampling consisting of dividing the population into subsets whose elements have common characteristics; that is, homogeneous strata inside (Arias, 2006). The determination of the size of the representative sample was made based on the following expression (Spiegel & Stephens, 2009):

$$n = \frac{Z_{\alpha}^2 * p * q}{e^2}$$

In this case, as suggested by Spiegel and Stephens (2009), the sample size is calculated under the scenario of maximum variability, that is, with $p = q = 0.5$, with a level of significance of 5%, a maximum estimation error of 0.10 (e), we obtain that the sample size is 67 construction project managers.

We conducted a pilot study in which 12 directors of construction projects with extensive experience and training in project management participated. The composition of the participants in the pilot test was 83.3% men and 16.6% women; 91.6% certified as a PMP Project Management Professional, the average age of the participants was 45.1 with a standard deviation of 4.6 years. The pilot study made it possible to improve the wording of some of the questions in the questionnaire. An exploratory factor analysis and an analysis of the Cronbach's alpha index were performed to the data that was obtained from the pilot study. The results of these two analyzes allowed confirming the validity of the instrument for the collection of the information, in that the questions or variables are grouped into factors that directly reflect the components of the model (Salem Alzahrani, 2015).

Finally, the instrument for collecting information based on Salem Alzahrani (2015), was made up of five sections related to the variables that make up the maturity model in the management of sustainable projects. The first section of the questionnaire gives the opportunity, to the project managers, to self-evaluate in relation to the current compliance with the policies and practices of sustainable development in the projects under their responsibility within the organization. For this self-evaluation, the participant can select between the following 5 levels of maturity, where the highest level of maturity corresponds to level 5:

Level 1: The organization does not establish sustainable practices nor sustainable standards for projects.

Level 2: Some practices or sustainable standards are included in some projects, but they are not a requirement for the entire organization.

Level 3: During the project execution process, sustainable practices and standards that are established by the organization are applied, and documented procedures and records are used.

Level 4: The organization establishes documented procedures and records for the application of sustainable practices and standards throughout the life cycle of the project. The objectives of the project are not included in the strategic direction of the organization.

Level 5: The organization establishes documented procedures and records for the application of sustainable practices and standards throughout the life cycle of the project. The objectives of the project

are included in the strategic direction of the organization. The organization implements tracking metrics to comply with sustainable practices in the projects, and continuous improvement practices for sustainable practices based on the data collected in level 4.

In addition, this first section of the questionnaire inquires on the level of sustainability (from 1 to 5) in the implementation of sustainability techniques and tools in the processes of the areas of knowledge of project management and, in the economic, social, and environmental dimensions of construction projects. Finally, in this first section of the questionnaire, it is inquired about the obtainment of a green or ecological certificate from the organization.

The second section of the questionnaire collects variables related to aspects of organizational culture such as employee management, the dominant characteristics of the organization, organizational leadership, strategic emphasis, and success criteria at the organizational level. The third section of the questionnaire collects data related to project variables such as internal and external criteria for the success of the project and benefits that the projects bring to the organization. The fourth section of the questionnaire is devoted to variables that are related to the concept of sustainable development and project management. Finally, the fifth section of the questionnaire collects socio-demographic information from the project-oriented organization and from the participant. In total, the questionnaire is composed of 78 questions, measured on a categorical scale of 5 levels. The questionnaires were applied via email and the analysis of the data was carried out using the statistical software R ®.

SOLUTIONS AND RECOMMENDATIONS

Electronic means were used in order to send and receive the questionnaires; a total of 392 were sent and only 73 were correctly completed and received, for a response rate of 18.6%, consistent with what is expected in this type of studies (Pagell et al., 2015). The first activity in the analysis of data was the filtering, in order to identify extreme values and double answers to any of the 78 questions that make up the questionnaire. As a result of this review, a total of 72 questionnaires were accepted, and they guarantee a size of sample that is representative of the population considered in this study.

As per the demographic analysis of the sample, we have: 93.1% of the participating project managers are men and the remaining 6.9% are women; 23.6% of the participants have certification as a professional in the management of PMP projects and the remaining 76.4% do not have PMP; 5.6% of the participants work in large construction companies, 23.6% work in medium-sized construction companies, and the remaining 61.1% work in small construction companies; 15.3% of the participants have less than 5 years of experience as a project manager, 25% have worked as project managers for 6 to 15 years, 44% have experience between 16 and 25 years, and the remaining 19.4% of the project managers participating in the study have more than 25 years of experience in the construction sector; the average age of the participants is 47.3 years, with a standard deviation of 7.8 years.

Figure 1 shows the distribution of the responses of the project managers when requesting them to self-evaluate with respect to the current level of sustainability in the management of the projects under their responsibility. It is clear that the vast majority of participants (81.9%) are in levels 1 and 2 of maturity. There is a 34.7% of the project managers who consider that the organization does not establish sustainable practices or standards for the projects, while 47.2% of the project managers consider that some of the construction projects include some sustainable practices or standards, but they are not a requirement

Sustainability on Project Management

for the entire organization. Only 15.3% of the participants selected level 3 maturity in sustainability in the management of projects of their organization, which corresponds to the implementation of sustainable practices and standards established by the organization during the project execution process, and documented procedures and records are kept. A scant 2.8% selected level 4 maturity in sustainability and none of the participants selected maturity level 5 in the project management model (Salem Alzahrani, 2015). In general, the results that are shown in figure 1 indicate the incipient implementation of sustainable development practices and standards in the management of construction projects in Colombia.

Regarding the use of techniques and tools related to the dimensions of sustainable development in the processes of the areas of knowledge in project management according to the PMBOK sixth edition, as it can be seen in figure 2, the results indicate again the predominance of the level 1 of maturity. When exploring these results in relation to level 2 of maturity in sustainability of the model of Salem Alzahrani (2015), one can find that the following are the areas of knowledge where more sustainable techniques and tools are applied in some projects, but they are not a requirement for the entire organization: stakeholder management, purchasing management, resource management, and scope management. Levels 4 and 5 of maturity in sustainability of project management were not selected by the participants.

When deepening in the three dimensions of sustainable development (economic, social, and environmental), it was found that on average, the level of maturity, selected by project managers, is greater in the economic dimension, followed by the social dimension, and finally with the lowest average in the environmental dimension, as shown in Figure 3. This result leads to infer that, in the construction sector, the priority criterion is related to obtaining financial benefits, and it is necessary to deepen strategies that

Figure 1. Distribution of maturity levels in the sustainability of construction project management

Source: Prepared by the authors

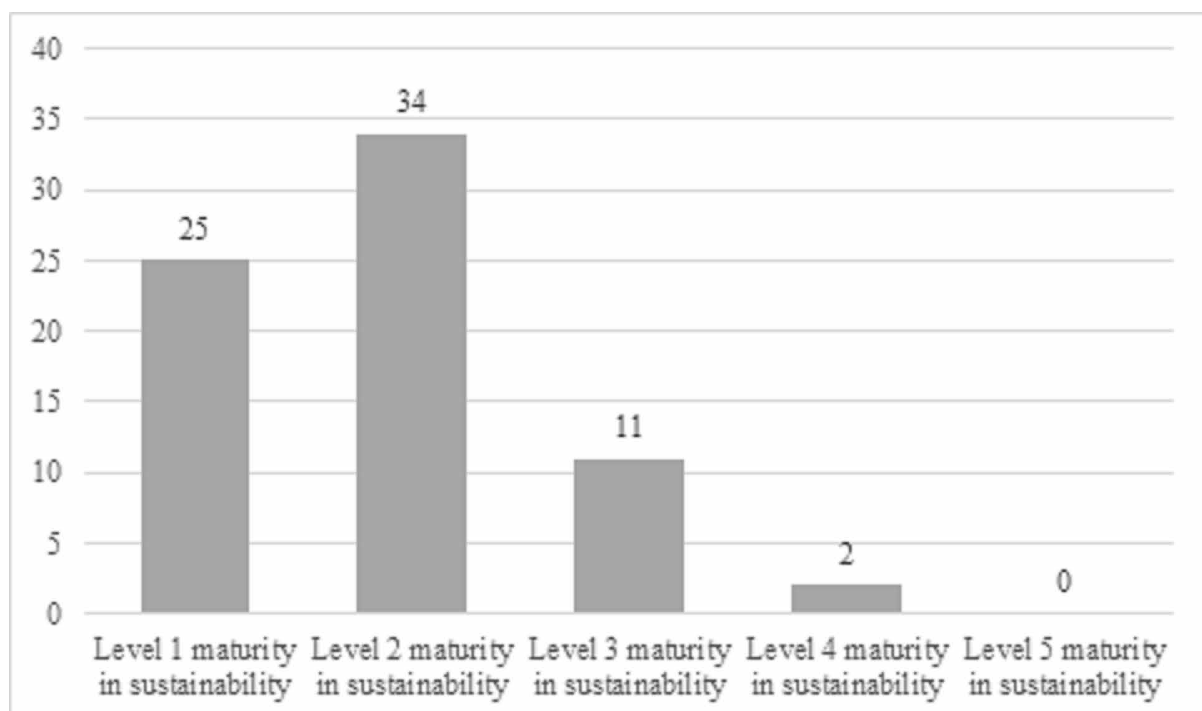
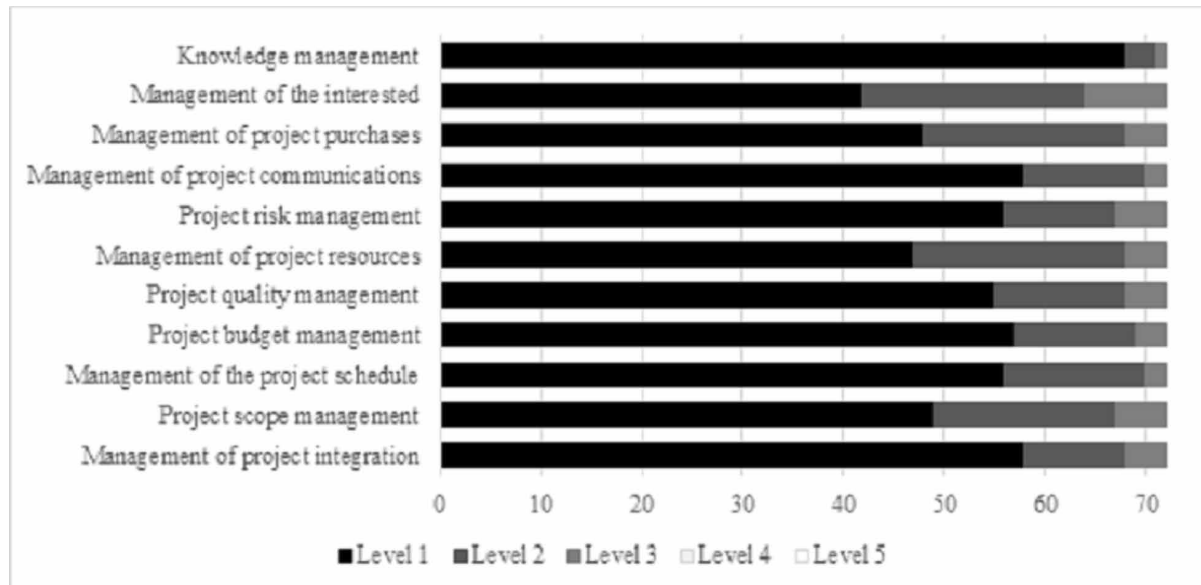


Figure 2. Application of sustainable techniques and tools to project management

Source: Prepared by the authors



allow to make managers of construction organizations aware of the importance of implementing social and environmental practices and standards throughout the life cycle of these projects.

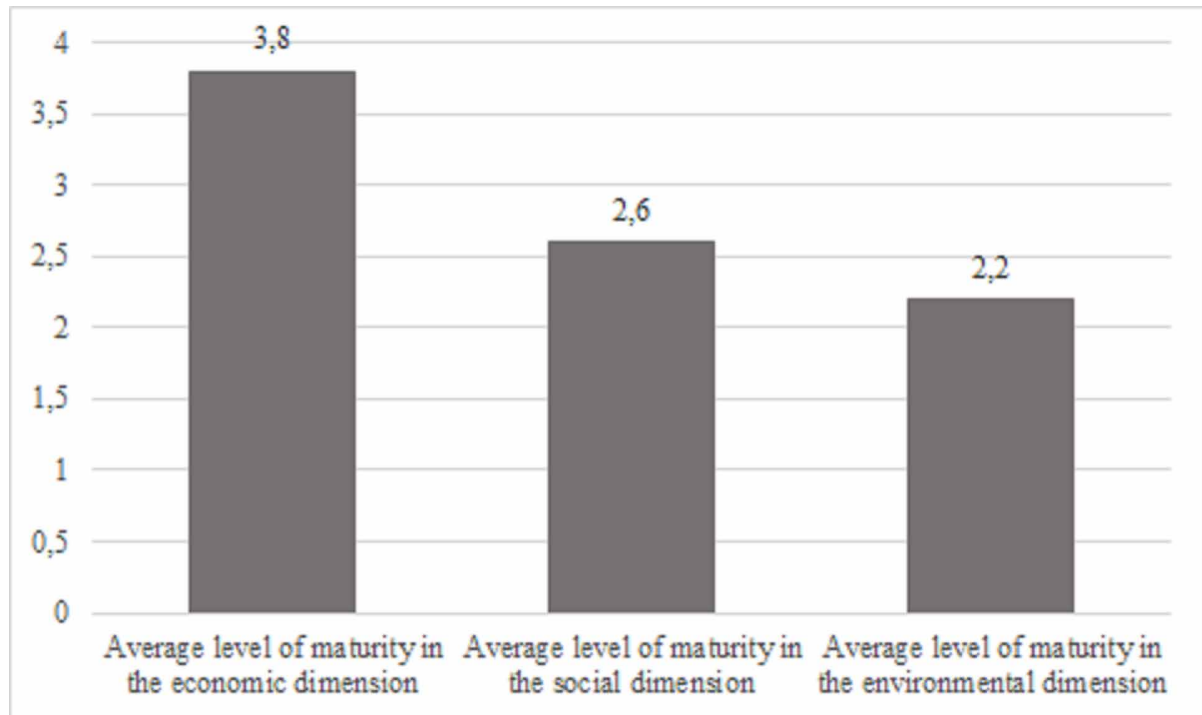
When analyzing the specific results obtained in the environmental dimension, it is found that the managers of construction projects perceive a high degree of maturity (levels 3, 4, and 5), and have selected the financial benefits and methods of evaluation, and the selection of future projects as those variables in which the organization establishes documented procedures to a greater extent, and seeks the alignment of the projects with the organizational strategy. These findings in the economic dimension of sustainable development, were consistent with those obtained by asking project managers about the priority expectations to be met with the projects of the organization. In this sense, once again, those managers consulted gave greater importance to the fulfillment of the expectations of delivering the project on time and under the budget than to social expectations.

When analyzing the levels of sustainability in the policies or project standards of the organization with respect to the elements of the social dimension, it was found that, in the opinion of the construction project managers who were consulted, the variables with the highest level of maturity were those related with health and safety at work, and with work practices and good working conditions. The results of this same social dimension indicate that the variables with a lower degree of maturity are related to training, educational programs, and the development of interest groups, with the diversity and equality of opportunities that reflect the society in which it operates and to implement corporate social responsibility programs aimed at the society in which the project operates.

When analyzing the levels of sustainability in the policies or project standards of the organization regarding the elements of the environmental dimension, it was found that, according to the perception of the managers of construction projects who were consulted, the variable with the highest level of maturity is related to the practices for the selection of materials for the project. However, the results found some weaknesses in the maturity of the sustainability of construction projects in Colombia, the variables re-

Figure 3. Average maturity level in the three dimensions of sustainable development

Source: Prepared by the authors



lated to waste management resulting from the project, energy consumption and water consumption, and pollution generated by the project activities. Finally, the managers of construction projects in Colombia were asked about obtaining some certificate, award, or mention thanks to the efforts of the organization in the matter of sustainable development or ecology, and found that none of the construction organizations to which those consulted belong has any of these distinctions.

The authors of this chapter wanted to deepen the analysis of the influence of the size of the organization oriented to projects and the average levels of maturity in each of the three dimensions of sustainable development. Project managers selected the size of their organization on a large, medium, or small scale. For this analysis, we proposed to test the equal means hypothesis of the levels of maturity in sustainability in the economic, social, and environmental dimensions for the three size categories of the organizations. To this effect, we used the multivariate statistical method of Analysis of Variance (ANOVA) for each dimension of sustainable development, testing the nullity hypothesis $H_0: \mu_1 = \mu_2 = \mu_3$, against the alternative hypothesis (H_1) that any of the means (μ_i) is not equal; where the subscripts 1, 2, and 3 refer to the size of the organization (large, medium, and small, respectively).

The result of the ANOVA for equality of average maturity level in the economic dimension for each size of the organization is shown in table 3. Table 3 shows both the general results of the ANOVA and the results of the multiple comparisons generated by means of the post-hoc Bonferroni contrast. The one-way ANOVA means comparison test shows a p value or observed significance of 0.214 that is greater than the test significance level of 0.05. With this result, there is not enough statistical evidence to reject the nullity hypothesis of equality of means. Therefore, it can be stated that the average level of maturity

in sustainability for the economic dimension is the same for large, medium, and small construction companies. In other words, the size of the organization does not influence the level of maturity in the economic dimension of sustainable development.

The same ANOVA analysis was performed to compare the average levels of maturity in the social dimension of sustainability, and the results are presented in table 4. Table 4 shows both the general results of the ANOVA and the results of the multiple comparisons generated by means of the post-hoc Bonferroni contrast. The one-way ANOVA means comparison test shows a p value or observed significance of 0.04 that is greater than the 5% test significance level. With this result, there is enough statistical evidence to reject the nullity hypothesis of equality of means. Therefore, it can be stated that the average level of maturity in sustainability for the social dimension is different for large, medium, or small construction companies. The significance observed for the multiple comparisons in table 4, allows us to identify that $\mu_{\text{large construction firms}} \neq \mu_{\text{medium construction firms}} \neq \mu_{\text{small construction firms}}$. In other words, the size of the organization influences the level of maturity in the social dimension of sustainable development. The average level of maturity in the social dimension was significantly higher in large construction companies when compared with the medium and small construction companies, and the average level of maturity in the social dimension was significantly higher in medium-sized construction companies than in the small ones.

Finally, table 5 presents the results of the ANOVA analysis to compare the average maturity level in sustainability in the environmental dimension according to the three organization sizes considered in this research. Table 5 also shows both the general results of the ANOVA and the results of the multiple comparisons generated by means of the post-hoc Bonferroni contrast. The one-way ANOVA means comparison test shows a p value or observed significance of 0.01 that is greater than the 5% test significance level. With this result, there is enough statistical evidence to reject the nullity hypothesis of equality of means. Therefore, it can be stated that the average level of maturity in sustainability for the environmental dimension is different for large, medium, or small construction companies. The significance observed

Table 3. Results of the ANOVA for the average level of sustainability in the economic dimension

	Sum of Squares	gl	Root Mean Squate	F	Sig.	
Among groups	1,369	2	,684	1,577	,214	
Within groups	29,951	69	,434			
Total	31,319	71				
Multiple comparisons						
Bonferroni						
(I) Type of construction firm	(J) Type of construction firm	Mean difference (I-J)	Standard error	Sig.	Confidence interval at 95%	
					Lower limit	Upper limit
Large	Medium	,374	,255	,440	-,25	1,00
	Small	,386	,222	,259	-,16	,93
Medium	Large	-,374	,255	,440	-1,00	,25
	Small	,012	,188	1,000	-,45	,47
Small	Large	-,386	,222	,259	-,93	,16
	Medium	-,012	,188	1,000	-,47	,45

Source: Prepared by the authors

Table 4. Results of the ANOVA for the average level of sustainability in the social dimension

	Sum of Squares	gl	Root Mean Square	F	Sig.	
Among groups	3,673	2	1,837	5,866	,004	
Within groups	21,604	69	,313			
Total	25,278	71				
Multiple comparisons						
Bonferroni						
(I) Type of construction firm	(J) Type of construction firm	Mean difference (I-J)	Standard error	Sig.	Confidence interval at 95%	
					Lower limit	Upper limit
Large	Medium	,617*	,217	,013	-,11	,95
	Small	,636*	,189	,004	,17	1,10
Medium	Large	-,617*	,217	,013	-,95	,11
	Small	,519*	,160	,025	-,17	,61
Small	Large	-,636*	,189	,004	-1,10	-,17
	Medium	-,519*	,160	,025	-,61	,17

*. The difference in means is significant at level 0.05.

Source: Prepared by the authors

for the multiple comparisons in table 5, allows us to identify that $\mu_{\text{large construction firms}} \neq \mu_{\text{medium construction firms}} \neq \mu_{\text{small construction firms}}$. In other words, the size of the organization influences the level of maturity in the environmental dimension of sustainable development. The average level of maturity in the environmental dimension is significantly higher in large construction companies when compared with the medium and small construction companies, and the average level of maturity in the environmental dimension is significantly higher in medium-sized construction companies than in the small ones.

FUTURE RESEARCH DIRECTIONS

The direction of future lines of research related to the topic of sustainability on project management in Colombia, is in line with the development of studies aligned to identify strengths and weaknesses of the management of projects in other sectors, such as engineering, information technology, and international cooperation. Likewise, the investigation of the maturity in the management of construction projects in Colombia, can be complemented by making characterizations in subpopulations arising from the sociodemographic data of the sample, such as the location of the construction company, the number and size of the projects executed by the construction company, the existence of a Project Management Office (PMO) in the construction company, and the level of competence in project management by those responsible for directing this type of projects

Table 5. Results of the ANOVA for the average level of sustainability in the environmental dimension

	Sum of Squares	gl	Root Mean Squate	F	Sig.	
Among groups	6,451	2	3,226	7,951	,001	
Within groups	27,993	69	,406			
Total	34,444	71				
Multiple comparisons						
Bonferroni						
(I) Type of construction firm	(J) Type of construction firm	Mean difference (I-J)	Standard error	Sig.	Confidence interval at 95%	
					Lower limit	Lower limit
Large	Medium	,540*	,246	,025	-,06	1,14
	Small	,841*	,215	,001	,31	1,37
Medium	Large	-,540*	,246	,025	-1,14	,06
	Small	,301*	,182	,038	-,15	,75
Small	Large	-,841*	,215	,001	-1,37	-,31
	Medium	-,301*	,182	,038	-,75	,15

* The difference in means is significant at level 0.05.

Source: Prepared by the authors

CONCLUSION

The objective of this work was to establish the level of maturity in the sustainability of the management of construction projects in Colombia, based on the perceptions of the project managers of the sector. The results of this research show that the organizations that are responsible for executing construction projects in Colombia must make bigger efforts to implement sustainable development practices and standards throughout the life cycle of their projects. According to the self-assessment carried out by the participants of this research, 81.9% of the organizations are only in levels 1 and 2 of maturity in sustainability of project management according to the model by Salem Alzahrani (2015). This means that 81.9% of construction project organizations in Colombia do not apply or only in some cases apply sustainability practices and standards in their projects.

The findings of this research indicate that none of the organizations that are responsible for construction projects in Colombia establish documented procedures for the implementation of sustainable development practices or standards during the entire life cycle of the project, developing monitoring metrics for continuous improvement in the economic, social, and environmental dimensions of sustainable development. These elements correspond to level 5 maturity in sustainability of project management, according to the model by Salem Alzahrani (2015). When deepening in each of these three dimensions, it could be established that in the opinion of construction project managers, the economic dimension predominates over the social and environmental dimensions in project management processes in their organizations.

When examining the perception of the project managers in the construction industry against the application of techniques and tools related to the three dimensions of sustainable development in the management of their projects, we also find the predominance of levels 1 and 2 of maturity in sustainability. Within these levels of maturity in sustainability, the areas of knowledge of the Project Manage-

ment Guide PMBOK from the Project Management Institute where greater techniques and sustainability tools are applied are: stakeholder management, procurement management, resources management, and scope management. It should be noted that, according to the opinion of the participants in the study, these techniques and tools are applied during the life cycle of the construction project without being a requirement of the organization.

The results of the ANOVA analysis of variance showed that there is not enough statistical evidence to establish that the average level of maturity in sustainability in the economic dimension is different in large, medium, and small organizations. The results of the comparison of the average level of maturity in sustainability in the social and environmental dimensions allows concluding that this average level of maturity is greater in large organizations than in medium and small sized ones. These results show that all large, medium, and small organizations give great importance to the economic dimension in the life cycle of construction projects. Likewise, these results allow us to conclude that it is necessary to generate adequate strategies so that in medium and small organizations the concept of sustainability in the management of construction projects is introduced and given importance, mainly in those related to the social and environmental dimensions; for example, the inclusion of “ecological footprint” and “carbon footprint” indicators within the monitoring metrics of this type of project management.

The authors of this chapter highlight explicit research limitations that are important when looking for generalizations of the results that were obtained. In the first place, because it is a cross-sectional investigation, and it is normal for the results to vary over time depending on the new realities of the construction project management in the Colombian context. And, in second place, the input information for the analysis that was conducted in this research comes from the perceptions of the project managers that were part of the sample group. Therefore, for the measurement of the variables of the maturity model in sustainability, no documentary evidence was considered.

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KEY TERMS AND DEFINITIONS

Economic Dimension: It refers to the capacity of public and private sectors to implement profitable practices from the economic point of view, without compromising the equilibrium with the social and environmental practices.

Environmental Dimension: It refers to the capacity of the current society to use natural resources in a rational and efficient way in order to ensure its conservation for the use of future generations.

Project Management: It corresponds to the application of hard and soft skills during the life cycle of a project in order to meet the objectives of the project.

Social Dimension: It consists of the capacity of the society to implement practices to ensure the respect to human rights, diversity, cultural traditions, and the rights of communities in order to decrease the gap between the rich and the poor and social justice.

Sustainability: It refers to the capacity of a society and of nations to implement strategies that allow satisfying the necessities of humanity today, compromising neither resources nor the development of future generations.

Chapter 13

Model Based on Ontological Engineering as Support for Stakeholder Management

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ABSTRACT

The objective of this article is a way of working that is used as an instrument for managing the parts with semantic and conceptual elements, such as mastery of management projects, and the effects of ontological engineering techniques, which solves frequently asked questions with respect to information related to this resource. This is done in an agile, precise, and effective way, facilitating its management in the phases that make up the life cycle of the project. The research will contribute to the integration of ontological engineering and project management, enabling the construction of a stakeholder information structure with semantic components that enable it to be the input of a more complex knowledge management model.

INTRODUCTION

Project management is defined as the discipline to organize and manage resources, the form of a given project that has been fully completed within the scope, time and cost constraints. In a more formal way, project management is the application of knowledge, skills and techniques to execute projects efficiently and effectively. It is a strategic competition for organizations, which allows them to see the results of

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projects to business goals and thus compete better in their market of action (Project Management Institute PMI, 2014). It is the sense of the recommendations issued for the project management of PMI, Prince 2 and IPMA (IPMA, 2015), as well as the report of management methods increasingly like Gantt chart, Pert chart, critical chain, value technique Cattle and Scrum among others, the principles of action to optimize the results of the project through constant improvements, the use of analysis tools, the estimation and measurement of variables.

The theory of these proposals include the management of the factors and variables that can be presented in the life cycle of a project; However, to achieve the total success of the project management is something that is very difficult, due to its nature, complexity, resources and environment, but above all for the actors that are part of it directly or indirectly. The identification, documentation and management of the people or groups and entities that participate in some way and at some point of the project, has become a high priority factor for managers, because of the experience and experience in executing projects, it is possible to conclude that this is one of the components of greater incidence in the success or failure of the same. The implementation of project management technologies in business is promoting a cultural change, because the information is shared among all employees and ownership around it generates new knowledge. This, in turn, is reflected on best practices and the development, implementation and collaboration on future activities and processes. The collaborative management technologies have been introduced in companies not only as a tool to solve problems with employees, suppliers or customers, but have fostered an environment of collaboration between all stakeholders, to share solutions, continuous improvement in time real and more and better attention to both internal and external customers (Díaz-Piraquive, Medina-García, & Joyanes-Aguilar, 2013).

The present paper exposes a supported proposal in the ontological engineering, whose objective is to propose an ontology model that serves as support to the management of the interested parties of a project, since this engineering defines the ontology as a structure and contents of form explicit, where implicit rules drawn from reality are determined, determining a formal and explicit specification of a shared conceptualization (Gruber, 2007). -Other definition is what is provided by Gruber, very relevant in this context where he says that an ontology is a set of terms of knowledge, which includes a vocabulary, relationships and a set of logical rules and inferences about a domain in particular " (Hendler, 2001).

THEORETICAL FOUNDATION

Ontologies

Since the 90s, ontologies have become a research topic for several Artificial Intelligence communities, including knowledge engineering, natural language processing and knowledge representation. Recently, the notion of ontology is also becoming generalized in fields such as the intelligent integration of information, the retrieval of information on the Internet and knowledge management. The reason why ontologies are so popular is largely because they promise: a shared and common understanding of domains that can be communicated between people and computers. The main motivation behind ontologies is that they allow sharing and reusing knowledge bodies in a computational way. In the Knowledge Exchange Effort project (EIC), ontologies are presented as a means to share the knowledge bases among the different EICs. The basic idea was to develop a library of reusable ontologies in a standard formalism, which each system developer can adopt (Studer & Fensel., 2010).

The term ontology comes from the philosophy that goes back to the attempt of Aristotle to classify things in the world, where it is used to describe the existence of beings in it. According to the definition offered by Gruber (2007) and later extended by Studer, Benjamins and Fensel (Hendler, 2001), an ontology is an explicit and formal specification of a conceptualization. Exactly, an ontology will be formed by a relational taxonomy of concepts and by a set of axioms or rules of inference through which new knowledge can be inferred. Currently ontology is a subject of research, development and application in disciplines related to computing, information, management and knowledge (Barchini & Herrera., 2006).

From the technological point of view, depending on the field, there are different meanings of ontology. In Artificial Intelligence, according to (Gruber, 2007), it is defined as: “an explicit specification of a conceptualization” and, in the discipline of IS, it is considered according to (Guarino, 1995) as: “a software artifact (or formal language) designed for a specific set of computational uses and environments.”

Therefore, it is not strange that artificial intelligence researchers have adopted the term ontology to describe what it can (computationally) represent of the world in a program. Some definitions of ontologies have occurred in the last decade, however some of the most characterized are offered by (Gruber, 1993); (Borst, 1997): An ontology is a formal, explicit specification of a shared conceptualization. A “conceptualization” refers to an abstract model of some phenomenon in the world having identified the relevant concepts of that phenomenon. “Explicit” means that the type of concepts used and the restrictions on their use are explicitly defined. “Formal” refers to the fact that the ontology must be machine-readable, which excludes natural language. “Shared” reflects the notion that an ontology captures consensual knowledge, that is, it is not private for an individual, but accepted by a group.

There are currently available ontologies dealing with modeling knowledge of the static domain, as opposed to knowledge of dynamic reasoning (for example, domain models in projects, power plants, mechanical machines). In its strongest form, an ontology tries to capture a universally valid knowledge, independently of the use, a vision closely related to its philosophical origin (Barchini & Herrera., 2006). A weaker, but still strong, ontology notion is the goal of capturing common sense human knowledge (Lenat & Guha, 1990). Other researchers intend to capture knowledge of the domain, regardless of the task or method that knowledge could use (Guarino, 1995).

In summary, it can be affirmed that within a given domain, an ontology is not just a representation, in a computer, of that domain. An ontology aims to reflect a certain consensus rate on knowledge in a domain. Ontologies differ in two aspects of taxonomies: they have a richer internal structure and reflect some consensus.

Project Management

According to Project Management Institute (2014) is a methodical approach to plan and guide project processes from start to finish. The processes are guided by five stages: initiation, planning, execution, control and closure. The project management is applied to any type of project and is widely used to control the phases of its life cycle. For its part (IPMA, 2015) states that it is “the planning, organization, monitoring and control of all aspects of a project, as well as the motivation of all those involved in it, to achieve the objectives of the project in a safe and satisfying way the defined specifications of term, cost and performance / performance. This also includes the set of tasks of leadership, organization and technical direction of the project, necessary for its correct development “In conclusion, it is a system of definition, planning and control of the project, whose principle is based on programming, organization and management of the different stages that make it up. The projects arise as a result of a specific need

or a business opportunity, however, due to the lack of planning and vision of the required scope, many times, these do not come to an end.

Figure No.1 shows a comparison between how projects were handled previously and how they are handled now, applying methodologies of project management.

Stakeholder

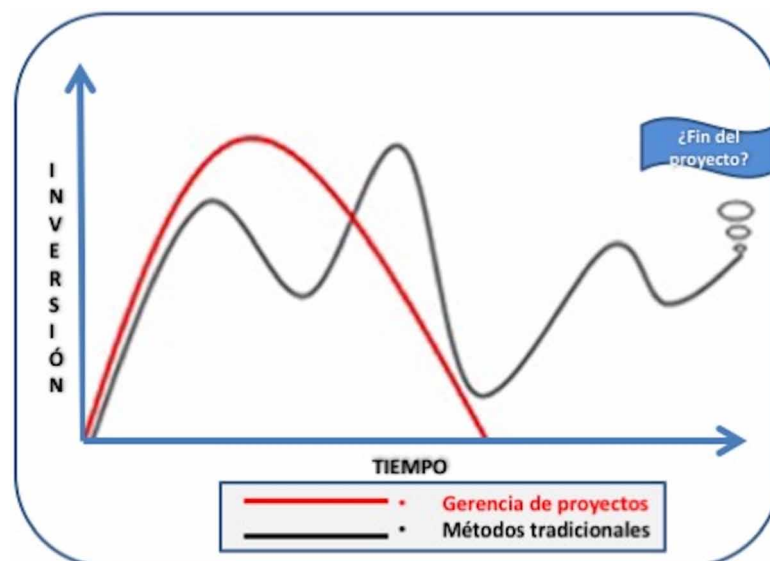
Interested is the one that brings together workers, shareholders, regulators, sponsors, suppliers, unions, neighborhood associations and social organizations, civil or government related, among many actors, which are key factors for the success of a company and that are they are affected, either favorably or unfavorably by their decisions. So, generating trust in them is a priority, for their development and evolution. This term was used for the first time by Edward Freeman in his book: “Strategic Management: A Stakeholder Approach” (Freeman & Moutchnik, 2013), to refer to “those who can affect or are affected by the activities of a company”. These groups or individuals are the interested stakeholders or the interested environment (“stakeholders”), which according to Freeman should be considered as an essential element in strategic business planning.

Because of the recurrence in the use of the term, it is important to specify that the translation of “stakeholder” has generated extensive debates in forums and social networks, however there are several experts who consider that the most correct translation is: “the interested party “(From the English stake, bet, holder, possessor). That is to say: “the person or entity affected or concerned by the activities or actions of an organization”.

Include the concept of “stakeholders” (stakeholders) was a great idea, which served, to end the prevailing paradigm, that a company only exists to maximize the benefit or better, to add value to its owner, the “shareholder” or the “stockholder” Although, the issue is not resolved, there are more than enough

Figure 1. Comparison of project management

Source: Authors



reasons to discern, if companies should be directed, only to maximize the profit of their shareholders, or if, other criteria must be taken into account, such as the existence of others "interested" or "stakeholders", people with some "stake" or interest in it, an idea that generates broad and detailed analysis of what is called "Stakeholder Management". If the company must take into account not only the interests of its owners, but also those of its customers, suppliers, managers, employees, local community, environment and society in general, then: how should that variety of interests be managed?. It is also important to keep in mind that the success factors of a project are grouped in the stakeholders' satisfaction. Social management of projects aims for project success through the use of tools that will strengthen the relations between those involved in the project which brings along a greater sense of belonging that will be reflected on the Project results (Díaz-Piraquive, Medina-García, & González-Crespo, ICT as a Means of Generating Knowledge for Project Management., 2014).

The experts have widely disseminated the concept of stakeholders, referring to people or groups that can have an impact on the results of the company, or that can receive them, as a consequence of their activity. However when the group consolidates and assimilates knowledge, a mechanism should exist to place refined knowledge at the organization's disposition. When knowledge is part of the organization, if adequate strategic guidelines exist, correct knowledge management is guaranteed, converting knowledge into a useful asset (Díaz-Piraquive, Medina-García, & González-Crespo, 2015).

METHODOLOGY

The model of ontology is generated from the partial application of the "Methontology" methodology developed by the Polytechnic University of Madrid. This proposes a life cycle of construction based on evolutionary prototypes, allowing to add, change and renew the terms defined from the initial taxonomy until reaching a new version. The phases exposed by this methodology are the following: (Uschold & King, 1995); (Grüniger & Fox, 1995); (Staab, Studer, Schnurr, & Sure, 2001).

Specification

It consists of constructing a specification document that includes the domain to which the Ontology refers, the date on which the development begins, who are the developers, the purpose, what level of formality Ontology will reach, its start-end borders, specifying the questions of competence and what are the sources of knowledge.

Conceptualization

This stage consists of organizing and converting an informal perception of project management in the area of knowledge of the administration of interested parties, into a semi-formal specification using a set of intermediate representations (tables, diagrams), so that it can be understood by the project managers and their work team. This phase is composed of 11 tasks: construction of the glossary of terms; of the concepts taxonomy; of the diagram of binary relations; from the dictionary of concepts; of the description of binary relationships; of the description of instance attributes; of the description of class attributes; of the description of constants; of the description of formal axioms; of the description of rules and, finally, of the definition of stays.

Formalization

The formalization in Methontology is not a compulsory activity; here the model becomes formal or semi-computable.

Implementation

It converts the previous model into a computable model; this can be achieved using translation tools of Ontological languages.

Maintenance

It consists of deleting, updating or including new instances from the redefinition of attributes, relationships, concepts or definitions.

Results

The ontology focused on Stakeholder Management, focusing on how to identify and manage project stakeholders and their requirements, expectations, attitudes and positions in front of it. The concepts, terms and other components used in the ontology are taken from the PMBOK® 6th Edition Guide, the theory of project management and the experience of success stories developed through consultancies.

Additionally, the ontology is proposed to face three stakeholder administration processes, defined as follows: the identification and analysis of the interested parties; temporary and functional location of the interested party in the life cycle of the project and, the monitoring and evaluation of the interested party during the life cycle of the project. This as an element of efficiency support of companies that use ICTs and trends on new services for customers in internal and external levels, it can be observed how companies become more specialized, flexible, efficient and competitive, this establishing the need of efficient change management and a constant knowledge renewal that allows the maximization of benefits (Díaz-Piraquive, Medina-García, & González-Crespo, 2014).

Specification

From the specification, the parameters of the ontology are characterized, as can be seen in Table 1. Specification of the Ontology.

Conceptualization

The conceptualization in a first task establishes the glossary of terms, reflected in Table 2. Glossary of Terms:

In the glossary of terms are synonyms (Table 3) and at the same time acronyms (Table 4).

Model Based on Ontological Engineering as Support for Stakeholder Management

Table 1. Requirements specification document: ontology management of stakeholders

Domain	Project Management - Stakeholder Management
Date	June de 2019
Developer	Beitmantt Geovanni Cárdenas Quintero
Purpose	The ontology proposed in this document is in the domain of project management, assuming it as the discipline of organizing and managing resources, so that a given project is completely completed within the constraints of scope, time and cost raised at the beginning.
Formality Level	Formal
Alcance	Currently, one of the most influential proposals in this discipline is that of the Project Management Institute PMI®, through recommendations presented in the PMBOK® Guide 6th Edition, which presents five groups of processes and ten areas of knowledge, where the groups of processes are defined as the set of activities related to each other, carried out to obtain a predefined product, result or service; and the areas of knowledge refer to the variables that allow the scope of a project to be developed within the times, the costs and the quality required by the client, to the management aspects that involve the interested parties, the communication between them and the risks that are generated if the integration of all those parts does not occur. The ontology is designed to deal with three stakeholder administration processes, defined as follows: • Identification and analysis of the interested parties • Temporary and functional location of the interested party in the life cycle of the project • Monitoring and evaluation of the interested party during the life cycle of the Project. The ontology will be able to resolve questions regarding the area of Stakeholders, such as: • You can consult the basic information of each interested party, names, surnames, age, address, telephone, email, city of residence, city of origin. • What is the level of education of each stakeholder? Or can you list the interested ones for a specific level of training. • What is the profession of each stakeholder? Or can those interested by profession be listed. • What postgraduate degrees does each interested party have? Or can those interested be listed for postgraduate degrees. • It will be possible to consult which interested parties have some type of certification, or those interested can be listed for a specific type of certification. • You can check the seniority of those interested in the organization. • You can consult the years of work experience of each interested. • What is the charge of each stakeholder? or can list the interested parties for a specific charge. • It can be consulted from a specific language that is dominated by interested parties, or by a specific interested party, which languages are dominant. • You can list the trends and customs of the interested party. • You can consult the role of an interested party in the project, or list them by type of role. • Which stakeholders are categorized as Internal and which are External? or can be listed by category. • Who are interested in the project with a Negative, Positive or Neutral interest? or can be listed by interest rate. • The interested parties can be consulted by type of high, medium or low influence, or a specific interested party that influences the project. • Stakeholders can be consulted by type of high, medium or low power, or a specific interested party that has power over the project. • Stakeholders can be consulted by type of high, medium or low impact, or a specific stakeholder that impacts the project. • You can consult the means of communication assigned to each interested party, or you can consult for a particular means of communication which interested are the referenced to use it. • You can consult in which group of management processes a stakeholder participates, or a group of management processes which interested parties are involved. • You can consult in which area of knowledge an interested participant, or an area of knowledge which interested parties are involved. • You can check which work packages a stakeholder participates in, or a work package which interested parties are involved. • It can be consulted if an interested party managed any request for change, or that change requests were handled by interested parties. • You can see what resources an interested party has assigned, or a resource which stakeholders are responsible for (be it a project resource or an organizational asset). • You can consult which strategy is associated with an interested party, or a strategy that stakeholders have involved. • You can check what changes were requested by an interested party. • You can see what events were generated by an interested party. • It will be possible to establish the level of performance that an interested party had in the activities to which he was assigned or in which he participated in some way. • The time of participation of an interested party in the project can be consulted. • The total cost generated by the participation of an interested party in the project can be consulted. • It will be possible to consult which project requirements an interested party is associated with. • You can consult which document an interested party is linked to (organization document or project document).
Sources of Knowledge	PMBOK® 6th Edition Guide

Taxonomy

The hierarchy of the taxonomy is established, since when the glossary of terms has a significant number of elements, a taxonomy is constructed that defines the hierarchy between concepts. To perform this taxonomy, you must select the terms classified as concepts in the glossary of terms and build the hierarchy. See material Figure 2. Taxonomy Diagram of Concepts in Interested Ontology.

Table 2. Glossary of terms. Source: The authors

Name	Description	Type
Stakeholder	Person or group of people or entity that can affect or be affected by a decision, activity or exit from the project.	Concept
Identification	It refers to the different ways in which a stakeholder can be identified in a timely manner, in terms of their personal data.	Concept
Identification Type	It refers to the type of document that identifies the stakeholder.	Concept
Professional Training	This refers to undergraduate, postgraduate and certification studies that a stakeholder can demonstrate.	Concept
Undergraduate Degree	This refers to the undergraduate degree(s) obtained by the stakeholder.	Concept
Specialization Degree	This refers to the specialization degree(s) obtained by the stakeholder.	Concept
Master's degree	This refers to the master degree(s) obtained by the stakeholder.	Concept
Doctoral Degree	This refers to the doctoral degree(s) obtained by the stakeholder.	Concept
Technical Degree	This refers to the technical degree(s) obtained by the stakeholder.	Concept
Certification	Refers to the standards certification (s) supported by the stakeholder.	Concept
Working Experience	It refers to the analysis that applies to a stakeholder in terms of work experience and job title in the company.	Concept
Job title	Role of which the Stakeholder has responsibility in an organization, agency or company.	Concept
Language	Language (s) spoken by the Stakeholder	Concept
Knowledge level	It reflects the knowledge and fluency of a foreign language, both in reading, listening and writing.	Concept
City	This concept refers to the city where the Stakeholder was born, lives and works.	Concept
Organization	Organization, company or entity to which the Stakeholder was linked or belongs.	Concept
Management Analysis	It refers to the analysis that applies to a stakeholder regarding different topics in their participation during the life cycle project.	Concept
Resource	Element or item used as a raw material to develop an activity.	Concept
Role	Role or function of the Stakeholder in the project.	Concept
Type	Classification that is given to the stakeholder in front of whether it is internal or external for the project.	Concept
Concern	Value or utility that the Stakeholder has on the project.	Concept
Influence	The quality that grants the ability to exercise control over power by a Stakeholder in the life cycle project.	Concept
Impact	An affection level that can generate a Stakeholder to make changes to the planning or execution of the project.	Concept
Power	Authority level of a Stakeholder during the life cycle project.	Concept
Strategy	Set of actions aimed at well-being and good organizational environment, during the life cycle project	Concept
Change	It refers to the adjustments requested by the Stakeholder to any aspect of the project at the management level or its objectives.	Concept
Event	Situation, circumstance or reason that makes difficult, impossible or facilitates the development of an activity during the life cycle project.	Concept
Performance	It is the result of the efficiency and effectiveness analysis that a stakeholder had of the activities to which the stakeholder was assigned or participated in some way during the life cycle project.	Concept
Requirement	These are the organization's needs and wishes in relation to achieving the project, or the solutions that will make it possible to achieve these goals.	Concept
Working Package	A working package is a quantitative and qualitative description of an operation to be carried out in the project, known as the lowest level of EDT decomposition.	Concept
Risk	It is an uncertain event or condition that, if it occurs, has an effect on at least one of the project's objectives. Objectives may include scope, timing, cost and quality.	Concept
Years of Experience	Refers to the amount of time the Stakeholder has been working.	Instance Attribute
Time of service	It refers to the amount of time the Stakeholder has been working within the organization.	Instance Attribute
ID_number	It refers to the document number that identifies the stakeholder.	Instance Attribute
Address	Address or geographic location where the Stakeholder is located	Instance Attribute
City	City where the Stakeholder lives	Instance Attribute

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Name	Description	Type
Telephone Number	Telephone number by which the Stakeholder can be contacted	Instance Attribute
Telephone Number	Telephone number by which the Stakeholder can be contacted	Instance Attribute
Email	E-mail address at which the Stakeholder can be contacted	Instance Attribute
Age	Age of stakeholder	Instance Attribute
Cost Unit	It is the amount of money that the project costs the stakeholder's participation in the life cycle project.	Instance Attribute
Time Unit	This is the amount of time that the stakeholder participates during the life cycle project.	Instance Attribute

Table 3. Synonyms. Source: The authors

Term	Synonym
Interesado	Stakeholder
Dirección	Ubicación

Table 4. Acronyms. Source: The authors

Term	Acronym
Type_Identification	C.C. PAS D.N.I.
Specialization Title	Esp.
Title Master	Msc.
Doctorate Degree	Dr.

Build a Diagram of Binary Relations

The relationship diagram aims to establish the relationships between the concepts of one or more concept taxonomies. It must be evaluated that the diagram created does not contain errors, both from a Top-Down view. See Figure 3. Relations Diagram with Top-Down Reading.

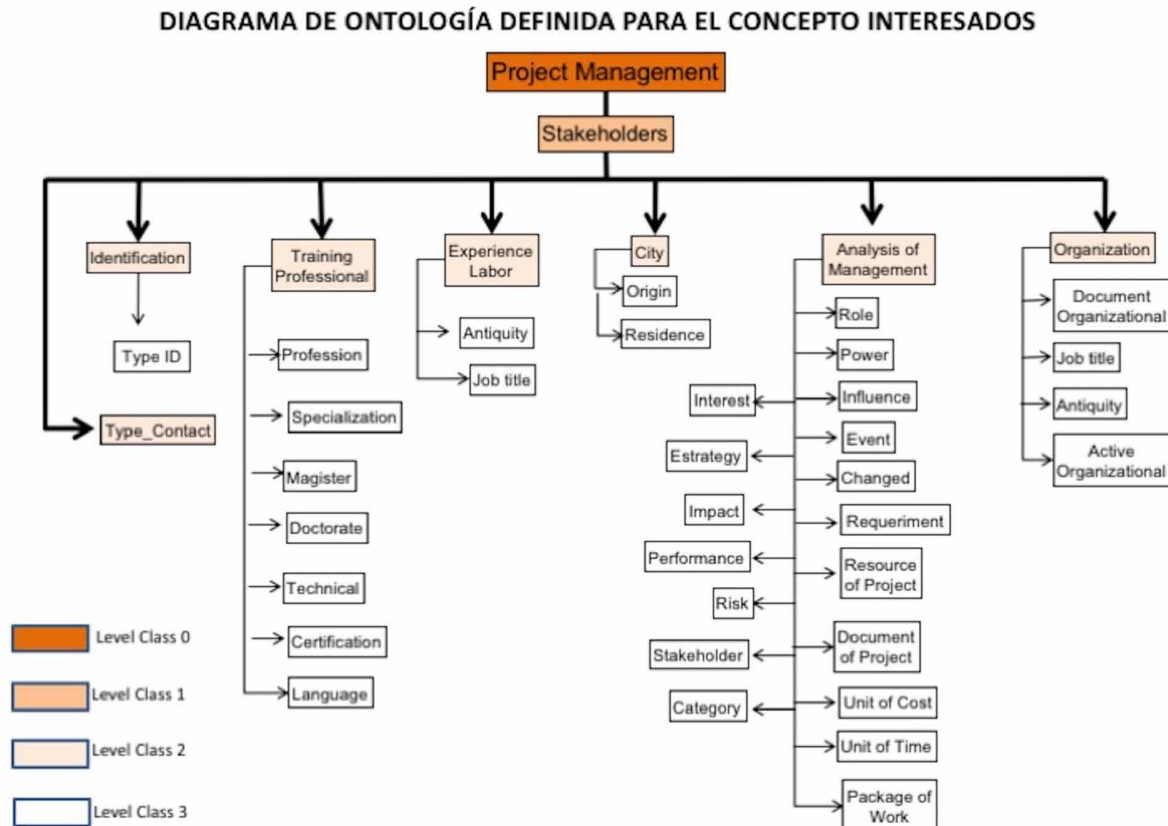
Additionally, a Bottom-Up view is generated. See Figure 4. Relationship Diagram with Bottom-Up Reading.

BUILD DICTIONARY OF CONCEPTS

The dictionary of concepts contains the concepts of the domain, its relations, instances, attributes of classes and attributes of instances. The relationships, attributes of instances, and attributes of classes

Figure 2. Taxonomy diagram of concepts in interested ontology

Source: Authors



are local to the concept, which means that their names can be repeated in different concepts. See Table 5. Dictionary of Concepts. In this item an example of a dictionary of concepts for a particular case is presented, making it clear that the instance depends on the project and the configuration of the reality of it, as follows:

In the same way, the dictionary of concepts of interest is constructed, from the identification, the level of training, the handling of languages, the labor situation, the customs and their characterization within the project.

In the description of attributes, the instances included in the dictionary of concepts are detailed (See Table 6. Table of description of attributes of instance).

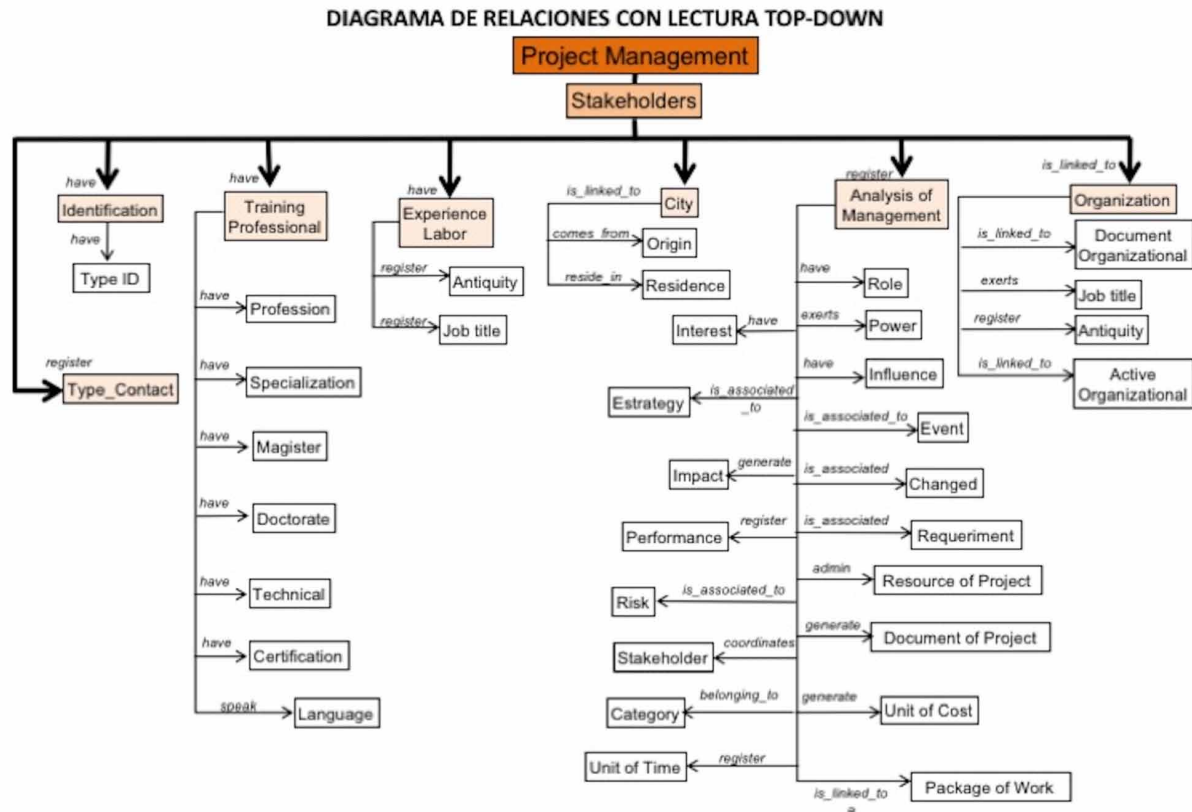
In the description in detail all the attributes of classes are included the dictionary of concepts (See Table 7. Table of Description of class attributes).

In the description of constants, each of the constants defined in the glossary of terms is detailed. For each constant, you must specify: name, type of value, value and unit of measure (for numerical constants). In this study there are no constants to be defined, since the concepts that are handled are not given by constant data.

To identify the formal axioms needed in the ontology and describe them accurately, in each definition of a formal axiom one must specify: name, description, logical expression that is formally described,

Figure 3. Relations diagram with top-down reading

Source: Authors



concepts, attributes and binary relations to which the axiom refers, as well as to the variables used. For this moment of the investigation, the axioms are represented in the middle of the binary relations that will be supported later by the table of rules.

The binary relations table is created in which all the binary relations included in the dictionary are described in detail. For each binary relationship it must be specified: name, source and destination concepts, cardinality and inverse relationship.

1. Stakeholder: Type_ Identification (table 8).
2. Stakeholder: Identification (table 9)
3. Stakeholder: Professional Training (table 10)
4. Stakeholder: Postgraduate Degree (this relationship applies to the Undergraduate, Specialization, Master and Doctorate degree) (table 11)
5. Stakeholder: Certification (table 12)
6. Stakeholder: Age of Work (table 13)
7. Stakeholder: Work Experience (table 14)
8. Stakeholder: Job title (table 15)
9. Stakeholder: Language (table 16)

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Table 5. Dictionary of concepts

Concept	Class Attributes	Instance Attributes	Instances	Relationships
		Type Identification	- Passaporte - Citizenship id	have
Stakeholder	Identification	Identification Number		have
		Names		have
		Surnames		have
		E-mail		have
		Communications Media	- E-mail - Phone Number - Report	is_contacted_by
		Address		have
		City of Origin	- Bogotá - Tunja - Medellín	have
		City of Residence	- Bogotá - Tunja - Medellín	have
	Nivel de Formación	Profession	- Industrial Engineering - Systems Engineering - Electronic Engineering	have
		Postgraduate Degree	- Project Management Specialization - Software Engineering Specialization - Communications Master's Degree - Public Law Master's Degree - PhD in Engineering - Project Management Doctorate	have
		Undergraduate		
		Specialization		
		Master's Degree		
		Doctorate		
		Technical		
		Certification	- PMP - CAMP - Oracle Certified Professional	have
	Job Analysis	Job title	- Planning manager - Secretary - Programmer - Editor-in-Chief	have
		Age of work	- 3 years - 8 months	have
		Experience Time	- 9 years - 9 months	have
	Language	High	- English - Portuguese - German	dominate
		Medium		
		Low		
	Project Analysis	Role	- Patrocinador - Gerente - Usuario - Proveedor	have
		Type	- Internal - External	have
		Concern	- Positive - Negative - Neutral	have

27. Stakeholder: City (table 34)

Concept	Class Attributes	Instance Attributes	Instances	Relationships
		Influence	- High - Low	performs
		Power	- High - Low	performs
		Impact	- High - Low	performs
		Work Package		is_related_to
		Change		is_related
		Resource	- Computer - Vehicle - Office - Device	manage
		Strategy		is_related_to
		Event		is_related_to
		Performance	- High - Medium - Low	log

Source: Authors

In the description of rules, which rules are required in the Ontology are specified and described in a rules table. For each rule, you must specify: name, description, expression that formally describes it, the concepts, attributes and relationships to which it refers, as well as the variables used in the expression, (see Table 35. Rule Description).

Once the conceptual model of the Ontology has been created, the relevant instances that appear in the dictionary of concepts in a table of instances are defined. For each instance you must specify: name, concept to which it belongs and values of the attributes, (see table No. 36. Description of Instances).

Formalization and Implementation in Methontology The formalization in Methontology is not a mandatory activity, both can be achieved using Ontological language translation tools.

CONCLUSION AND CONTRIBUTIONS

The development of the research established a semantic construction based on the ontological engineering between the management of stakeholders and their characterization according to the management of projects, taking into account the conceptualization of terms and the commitment that these must assume within each one of them. The phases of the life cycle of the project. This work contributed the following results.

The construction of a detailed taxonomy, in relation to the role and commitment that the stakeholders must assume within the planning, execution, monitoring, control and closure of the projects.

The detailed conceptualization and modeling of the domains of the language of stakeholder management, which contributes to the use of terms, tools, applications and procedures, among others, which may be useful at the time of making decisions by the manager of the project, as well as for all its team of collaborators, by quickly having accurate information, clear requirements and understanding of needs.

The integration of ontological engineering with project management facilitates the structuring of information that can be generated from the characterization of each stakeholder and the relationships

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Table 6. Description of instance attributes

Attribute Name	Concept to which it belongs	Value Type	Range	Cardinality
Identification Type	Identification	Character string		1-1
Identification Type	Identification	Character string	Caracteres ASCII [48-57]	1-1
Names	Identification	Character string		1-n
Surnames	Identification	Character string		1-n
Address	Identification	Character string		1-n
City of Origin	Identification	Character string		1-1
City of Residence	Identification	Character string		1-1
E-mail	Contact Type	Character string		1-n
Phone Number	Contact Type	Character string	Caracteres ASCII [48-57]	1-n
Mobile Number	Contact Type	Character string	Caracteres ASCII [48-57]	1-n
Undergraduate	Professional Training	Character string		1-n
Specialization	Professional Training	Character string		1-n
Master	Professional Training	Character string		1-n
Doctorate	Professional Training	Character string		1-n
Certification	Professional Training	Character string		1-n
Degree Name	Professional Training	Character string		1-n
Graduation date	Professional Training	Character string		1-n
Certifying University	Professional Training	Character string		1-n
Job title	Work Experience	Character string		1-1
Age of work	Work Experience	number	0 - 100	1-1
Work experience	Work Experience	number	0 - 100	1-1
Job title name	Job title			
Length of job title	Job title			
Organization	Job title			
Role	Management Analysis	Character string		1-n
Type	Management Analysis	Character string		1-1
Concern	Management Analysis	Character string		1-1
Influence	Management Analysis	Character string		1-1
Power	Management Analysis	Character string		1-1
Impact	Management Analysis	Character string		1-1
Work Package	Management Analysis	Character string		1-n
Management Processes Group	Work Package	Character string		1-n
Knowledge Area	Work Package	Character string		1-n
Change Management	Management Analysis	Character string		1-n
Resource	Management Analysis	Character string		1-n
Strategy	Management Analysis	Character string		1-n
Change Request	Management Analysis	Character string		1-n
Event	Management Analysis	Character string		1-n
Performance	Management Analysis	Character string		1-n
Cost Unit	Management Analysis	Character string		1-n
Time Unit	Management Analysis	Character string		1-n

Source: The authors

Table 7. Description of class attributes

Attribute Name	Concept to which it belongs	Value Type	Cardinality
Identification	Stakeholder	Character string	1-1
Contact Type	Stakeholder	Character string	1-n
Vocational Training	Stakeholder	Character string	1-n
Work Experience	Stakeholder	Character string	1-n
Language	Stakeholder	Character string	1-n
City	Stakeholder	Character string	1-n
Management Analysis	Stakeholder	Character string	1-n
Organization	Stakeholder	Character string	1-n

Source: The authors

Table 8. Stakeholder: type_identification

Concept	Binary Relation	Concept
Stakeholder	Have	Type_identification
Cardinality		
1 → 1 A Stakeholder Has One Type_ Identification		
Inverse Relation		
Type_identification	identifies	Stakeholder
Cardinality		
1 → 1 A Type_ Identification identifies one stakeholder		

Source: The authors

Table 9. Stakeholder: identification

Concept	Binary Relation	Concept
Stakeholder	have	ID_number
Cardinality		
1 → 1 A Stakeholder has One ID_Number		
Inverse Relation		
ID_number	identifies	Stakeholder
Cardinality		
1 → 1 An ID_Number identifies one Stakeholder		

Source: The authors

Table 10. Stakeholder: professional training

Concept	Binary Relation	Concept
Stakeholder	have	Professional Training
Cardinality		
1 - - - -> n A stakeholder can have many professional trainings		
Inverse Relation		
Professional Training	classifies	Stakeholder
Cardinality		
1 - - - -> n One Vocational training classifies many stakeholders		

Source: The authors

Table 11. Stakeholder: postgraduate degree

Concept	Binary Relation	Concept
Stakeholder	have	Postgraduate Degree
Cardinality		
1 - - - -> n One stakeholder can have many Post-Graduate Degrees		
Inverse Relation		
Postgraduate Degree	classifies	Stakeholder
Cardinality		
1 - - - -> n A Post-Graduate Degree classifies many stakeholders		

Source: The authors

between them, which implicitly establish rules of behavior and functionality in the middle of the life cycle of a project.

The representation of the information under the ontological model, proposes a new technique for extracting information, in a filtered way with specific search criteria, thus making the identification of the required actor more efficient and precise, either by its characteristics, competencies, location or role within the project.

The proposed ontology remains as a formal specification that provides a way to represent knowledge in the area of the interested parties, with the purpose of facilitating communication, reusing and sharing information among those involved in a project, in organizations, their information systems.

The investigation leaves raised a starting point for another level of deepening, for the implementation of axioms supported in algorithms based on artificial intelligence, in such a way that it optimizes the decision making in the management of the interested ones.

At this point of the investigation, we can glimpse a new proposal for the implementation of semantic information structures based on ontologies, applied to project management, which at the same time serves as a support for the planning of projects based on concepts and relationships between these. This sug-

Table 12. Stakeholder: certification

Concept	Binary Relation	Concept
Stakeholder	have	Certification
Cardinality		
1 - - - -> n A stakeholder can have many certifications		
Inverse Relation		
Certification	classifies	Stakeholder
Cardinality		
1 - - - -> n A Certification classifies many stakeholders		

Source: The authors

Table 13. Stakeholder: age of work

Concept	Binary Relation	Concept
Stakeholder	have	Age of work
Cardinality		
1 - - - -> 1 A stakeholder can have an age of work		
Inverse Relation		
Age of work	classifies	Stakeholder
Cardinality		
1 - - - -> n An age of work classifies many stakeholders		

Source: The authors

Table 14. Stakeholder: work experience

Concept	Binary Relation	Concept
Stakeholder	have	Work Experience
Cardinality		
1 - - - -> n A stakeholder can have many work experiences		
Inverse Relation		
Work Experience	classifies	Stakeholder
Cardinality		
1 - - - -> n A Work Experience classifies many stakeholders		

Source: The authors

Table 15. Stakeholder: job title

Concept	Binary Relation	Concept
Stakeholder	have	Job title
Cardinality		
1 - - - -> 1 A stakeholder can have a job title		
Inverse Relation		
Job title	classifies	Stakeholder
Cardinality		
1 - - - -> n A Job title classifies many stakeholders		

Source: The authors

Table 16. Stakeholder: language

Concept	Binary Relation	Concept
Stakeholder	dominate	Language
Cardinality		
1 - - - -> n A stakeholder can dominate many languages		
Inverse Relation		
Language	classifies	Stakeholder
Cardinality		
1 - - - -> n A Language classifies many stakeholders		

Source: The authors

Table 17. Stakeholder: role

Concept	Binary Relation	Concept
Stakeholder	have	Role
Cardinality		
1 - - - -> n A stakeholder can have many roles		
Inverse Relation		
Role	classifies	Stakeholder
Cardinality		
1 - - - -> n A Role classifies many stakeholders		

Source: The authors

Table 18. Stakeholder: type

Concept	Binary Relation	Concept
Stakeholder	have	Type
Cardinality		
1 - - - -> 1 A stakeholder belongs to One Type		
Inverse Relation		
Type	classifies	Stakeholder
Cardinality		
1 - - - -> n One type classifies many stakeholders		

Source: The authors

Table 19. Stakeholder: concern

Concept	Binary Relation	Concept
Stakeholder	have	Concern
Cardinality		
1 - - - -> 1 A stakeholder has a concern		
Inverse Relation		
Concern	classifies	Stakeholder
Cardinality		
1 - - - -> n A Concern classifies many stakeholders		

Source: The authors

Table 20. Stakeholder: influence

Concept	Binary Relation	Concept
Stakeholder	have	Influence
Cardinality		
1 - - - -> 1 A Stakeholder have an Influence		
Inverse Relation		
Influence	classifies	Stakeholder
Cardinality		
1 - - - -> n An Influence classifies many stakeholders		

Source: The authors

Table 21. Stakeholder: power

Concept	Binary Relation	Concept
Stakeholder	have	Power
Cardinality		
1 - - - -> 1 A stakeholder exerts a Power		
Inverse Relation		
Power	classifies	Stakeholder
Cardinality		
1 - - - -> n A Power classifies many stakeholders		

Source: The authors

Table 22. Stakeholder: impact

Concept	Binary Relation	Concept
Stakeholder	generate	Impact
Cardinality		
1 - - - -> 1 A stakeholder generates an impact		
Inverse Relation		
Impact	Prioritizes	Stakeholder
Cardinality		
1 - - - -> n An Impact Prioritizes Many Stakeholders		

Source: The authors

Table 23. Stakeholder: contact type

Concept	Binary Relation	Concept
Stakeholder	is_contacted_by	Communication media
Cardinality		
1 - - - -> n A stakeholder is_contacted_by Many communication media		
Inverse Relation		
Impact	classifies	Stakeholder
Cardinality		
1 - - - -> n A communication media classifies many stakeholders		

Source: The authors

Table 24. Stakeholder: requirements

Concept	Binary Relation	Concept
Stakeholder	is_related_to	Requirement
Cardinality		
1 - - - -> n A stakeholder is related with many requirements		
Inverse Relation		
Requirement	Links	Stakeholder
Cardinality		
1 - - - -> n A requirement links many stakeholders		

Source: The authors

Table 25. Stakeholder: risk

Concept	Binary Relation	Concept
Stakeholder	is_related_to	Risk
Cardinality		
1 - - - -> n A stakeholder is related with many risks		
Inverse Relation		
Risk	Links	Stakeholder
Cardinality		
1 - - - -> n A Requirement Links Many Stakeholders		

Source: The authors

Table 26. Stakeholder: work package

Concept	Binary Relation	Concept
Stakeholder	is_related_to	Work package
Cardinality		
1 - - - -> n A stakeholder is related to many work packages		
Inverse Relation		
Work package	Links	Stakeholder
Cardinality		
1 - - - -> n A work package links many stakeholders		

Source: The authors

Table 27. Stakeholder: resource

Concept	Binary Relation	Concept
Stakeholder	manage	Resource
Cardinality		
1 - - - -> n A stakeholder manages many resources		
Inverse Relation		
Resource	classifies	Stakeholder
Cardinality		
1 - - - -> n One resource is _managed_by many stakeholders		

Source: The authors

Table 28. Stakeholder: strategy

Concept	Binary Relation	Concept
Stakeholder	is_related_to	Strategy
Cardinality		
1 - - - -> n A stakeholder is related with many strategies		
Inverse Relation		
Strategy	Links	Stakeholder
Cardinality		
1 - - - -> n A strategy links many stakeholders		

Source: The authors

Table 29. Stakeholder: chance

Concept	Binary Relation	Concept
Stakeholder	is_related_to	Change
Cardinality		
1 - - - -> n A stakeholder is related with many changes		
Inverse Relation		
Change	Links	Stakeholder
Cardinality		
1 - - - -> n A change links many stakeholders		

Source: The authors

Table 30. Stakeholder: organization

Concept	Binary Relation	Concept
Stakeholder	Is_link_to	Organization
Cardinality		
1 - - -> n A stakeholder is linked to many organizations		
Inverse Relation		
Organization	links	Stakeholder
Cardinality		
1 - - -> n An organization links many stakeholders		

Source: The authors

Table 31. Stakeholder: event

Concept	Binary Relation	Concept
Stakeholder	is_related_to	Event
Cardinality		
1 - - -> n A stakeholder is related with many events		
Inverse Relation		
Event	links	Stakeholder
Cardinality		
1 - - -> n An event links many stakeholders		

Source: The authors

Table 32. Stakeholder: performance

Concept	Binary Relation	Concept
Stakeholder	logs	Performance
Cardinality		
1 - - -> n A stakeholder logs many levels of performance		
Inverse Relation		
Performance	classifies	Stakeholder
Cardinality		
1 - - -> n A performance level classifies many stakeholders		

Source: The authors

Table 33. Stakeholder: stakeholder

Concept	Binary Relation	Concept
Stakeholder	coordinate	Stakeholder
Cardinality		
1 ---> n One stakeholder coordinates many Stakeholders		
Inverse Relation		
Stakeholder	is_coordinated_by	Stakeholder
Cardinality		
1 ---> 1 A Stakeholder is coordinated by a stakeholder		

Source: The authors

gests that in the next phase of the research, ontologies can be modeled for the other management areas that intervene in a project, areas such as those proposed by the Project Management Institute (PMI), also known as management areas: integration, scope, terms, costs, quality, human resources, communication, risks, acquisitions and the one already modeled in this chapter “Interested”.

For the closing of this phase of the research, the formalization of the following ontology to be modeled is presented, the ontology of an element in project management that has to do with the work breakdown structure in the scope management area, presenting itself thus:

In project management it is proposed to have starting points for management, one the Scope, two the Cost and three the Time, known as the concept of the triple restriction, accompanied by factors of quality, risk, communications, among others. In my experience I can say that if you know what you have to do, if you have clear parameters under which you have to do it, and you know what resources you have to do it, it is easier to determine how long you can do it do. However, it is worth noting that the determining factor for estimating costs, resources, time and others is to be totally clear, what to do, therefore, it can be said that the incorrect specification, documentation or interpretation of the requirements of the project, can give you a starting point that leads directly to failure even before starting its execution.

Table 34. Stakeholder: city

Concept	Binary Relation	Concept
Stakeholder	is_linked_to	City
Cardinality		
1 ---> n A stakeholder is linked to many cities		
Inverse Relation		
City	locates	Stakeholder
Cardinality		
1 ---> 1 A city locates many stakeholders		

Source: The authors

Table 35. Description of rules

Rule Name	Description	Concept	Attribute	Relationship
Stakeholder identification	A stakeholder is uniquely identified by something that takes personal data from it. In other words, an identification only refers to one stakeholder in the project.	Stakeholder	- Identification type - ID_Number - Names - Surnames - E-mail - Contact phone - Address - City of origin - City of residence	Stakeholder - identification
Professional training of a stakeholder	A stakeholder may or not have, one or more professional qualifications, postgraduate degrees and/or certifications at the same time, in addition to a specific professional training, will allow to classify stakeholders that have it.	Stakeholder	- Professional Degree - Postgraduate Degree - Certification	Stakeholder – Professional training
Stakeholder's work experience	A stakeholder may or may not have a job analysis, where it reports the job title held in the organization where the project is being developed, the length of time worked in that company and the length of experience in their professional life. At the same time an analysis for each of these variables can classify a group of stakeholders or identify one of them in particular.	Stakeholder	- Job title - Age of work - Work experience	Stakeholder – Job Analysis
Language fluent Stakeholder	A stakeholder may or may not be fluent in one or more languages, or a particular stakeholder group or language may be classified.	Stakeholder	- Language name	Stakeholder – Language
Stakeholder customs	Un interesado puede tener una o varias Costumbres que hacen parte de su vida rutinaria, o por ejemplo se puede clasificar un grupo de interesados por el tipo de comida que más les guste.	Stakeholder	- Sports - Cultural - Gastronomy	Stakeholder - customs
Stakeholder role	A stakeholder can have one or more roles during the life cycle project. In some cases, it is possible to identify a group of stakeholders or one in particular according to its role within the project.	Stakeholder	- Role name	Stakeholder – Role
Stakeholder type	A stakeholder is categorized as internal if it works within the organization or with the project's work team, or external if it belongs to an external agent of the organization where the project is implemented. At the same time, those interested may be classified according to the type.	Stakeholder	- Type name	Stakeholder - type
Concern rate of stakeholders	A stakeholder has a concern type towards the project during its life cycle, which is typified as positive, negative or neutral. At the same time, a group of stakeholders or one in particular can be classified by the concern rate on the project.	Stakeholder	- Concern type	Stakeholder – concern
Stakeholder influence	A stakeholder has a type of influence on the project during its lifecycle, which is typified as a high or low influence. At the same time, a group of stakeholders can be classified according to the level of influence on the project.	Stakeholder	- Influence type	Stakeholder – influence
Stakeholders' Level of Impact	A stakeholder has an Impact level against the project during its lifecycle, this is typified as High Impact or Low Impact. At the same time, a group of stakeholders or one in particular can be classified by the level of Impact on the project.	Stakeholder	- Impact Level	Stakeholder – Impact
Contact resources to a stakeholder	A stakeholder is contacted by a communication media by other interested parties, and at the same time it is possible to classify a group of stakeholders by a specific communication media.	Stakeholder	- Communication media	Stakeholder – Communication media
The Management Process Group where the stakeholder acts	A stakeholder participates in one or more Management Process Groups during the life cycle project. At the same time, it is possible to determine which stakeholders participate in a particular Management Process Group.	Stakeholder	- Management Process Group name.	Stakeholder – Management Process Group.
The Knowledge Area where the stakeholder participates	A stakeholder participates in one or more Knowledge Areas during the life cycle of the project. At the same time, it is possible to determine which stakeholders participate in a Knowledge Area.	Stakeholder	- Knowledge Area name	Stakeholder – Área de conocimiento
Work packages where the stakeholder participates	A stakeholder participates in one or more Work packages during the life cycle project. At the same time, it is possible to determine which stakeholders are participating in a Work Package	Stakeholder	- Work packages	Stakeholder – Work packages
Stakeholder's resources	A stakeholder is assigned one or more Resources during the life cycle of the project, at the same time it is possible to classify which stakeholder (s) were assigned a given Resource.	Stakeholder	- Resource name	Stakeholder – Resource

continued on following page

Model Based on Ontological Engineering as Support for Stakeholder Management

Table 35. Continued

Rule Name	Description	Concept	Attribute	Relationship
Strategies for stakeholders	A stakeholder is applied one or more Strategies during the life cycle of the project, at the same time it is possible to classify to which stakeholder (s) a specific Strategy was applied.	Stakeholder	- Strategies	Stakeholder – Strategies
Changes managed by a stakeholder	A stakeholder manages one or more changes during the life cycle of the project, at the same time it is possible to classify which stakeholder managed a given change.	Stakeholder	- Change	Stakeholder – Changes
Changes requested by a stakeholder	A stakeholder requests one or more changes during the life cycle of the project, while it is possible to classify which stakeholder requested a particular change.	Stakeholder	- Change	Stakeholder – Changes
Events generated by a stakeholder	A stakeholder generates one or more Events during the life cycle of the project, at the same time it is possible to classify which stakeholder generated a given Event.	Stakeholder	- Event	Stakeholder – Events
Performance levels registered by a Stakeholder	A stakeholder logs Performance level during the project lifecycle, while it is possible to classify which stakeholders logged a given Performance level.	Stakeholder	- Performance Level	Stakeholder – Performance Level

Source: The authors

Table 36. Description of instances

Concept name	Class Attributes	Instance Attributes	Instances
Stakeholder	Identification	Identification Type	- Citizenship Number - Passport
		ID_Number	
		Names	
		Surnames	
		E-mail	
		Phone Contact	
		Address	
		City of Origin	- Bogotá - Tunja - Medellín
		City of Residence	- Bogotá - Tunja - Medellín
	Education Level	Profession	- Industrial Engineering - Systems Engineering - Electronics Engineering
		Postgraduate Degree	- Project Management Specialization - Software Engineering Specialization - Communications Master's Degree - Public Law Master's Degree - PhD in Engineering - Project Management Doctorate
		Certification	- PMP - CAMP - Oracle Certified Professional
	Job Analysis	Job title	- Planning manager - Secretary - Programmer - Editor-in-Chief
		Age of Work	- 3 years - 8 months
		Experience Time	- 9 years - 9 months
	Language	Name	- English - Portuguese - German
		Level	- Basic - Intermediate - Advanced

continued on following page

Table 36. Continued

Concept name	Class Attributes	Instance Attributes	Instances
Stakeholder (continued)	Project Analysis	Role	- Sponsorship - Manager - User - Supplier
		Type	- Internal - External
		Concern	- Positive - Negative - Neutral
		Influence	- High - Low
		Power	- High - Low
		Impact	- High - Low
		Communication Media	- E-mail - Mobile phone - Phone number - Report
		Work Package	See EDT Ontology
		Change	Any change requested by any stakeholder
		Resource	- Computer - Vehicle - Office - Device
		Strategy	Any action taken by a stakeholder to positively impact the project.
		Event	Any event that presents in the project and is representative for its documentation.
		Performance	- High - Medium - Low
		Cost Unit	Any value representing the monetary cost of a stakeholder's participation during the life cycle of the project.
		Time Unit	Total time of stakeholder participation during the life cycle of the project.

Source: The authors

In the different practices and recommendations in the theory of project management, strategies are proposed to clearly define the scope of the project, and therefore its management throughout it. In the case of PMI (Project Management Institute), they determine the management of the scope as all the processes that ensure that what is to be done is done and nothing more than that, besides this they emphasize differentiating the own activities to execute the project and the activities that imply to elaborate the product (s) that is expected of the project. With the families of the ISO guidelines, we have 10006: 2003 and ISO 9004, which support the orientation towards quality in the project management processes, the guidance on quality in the processes related to the product of the project, and on the “process-based approach”, and its scope management approach, proposes that the concept should be developed in the sense of defining the master lines of the final infrastructure, identifying the activities and steps to be carried out, but with a control that guarantees us the achievement of the objectives.

In the case of AIPM (National Competence Standards for Project Management), in its certifications it takes the management of the scope, supporting the definition of the context of the project, helping the definition, the application of controls, planning and directing the scope of the program / project throughout the life cycle, direct the activities of the change of scope, direct the exit criteria of the program / project (AIPM). Among these and other recommendations such as ITIL, CMMi, the issue of scope management is taken into account as a vitally important factor, since not only is it limited to capturing the requirements posed by the client of the project, but also a analysis if in fact it is what the problem merits in its solution, or if they are exceeding in requirements or on the contrary, with the raised requirements the solution that meets the objectives of the project is not reached.

Table 37. Requirements specification document: ontology management of WBS

Domain	Project Management - PMI Approach - Scope Management Knowledge Area - Planning Process - Process of the creation of the WBS.
Date	June 2019
Developer	Beitmantt Geovanni Cárdenas Quintero
Purpose	The purpose of ontology is to structure, formalize, standardize, unify the concepts, relationships and taxonomy that can be generated when creating an EDT.
Formality Level	Formal
Alcance	Currently, one of the most influential proposals in this discipline is that of the Project Management Institute PMI®, through recommendations presented in the PMBoK in its 6th. Edition, this presents five groups of processes and ten areas of knowledge, where the groups of processes are defined as the set of activities related to each other, carried out to obtain a product, result or predefined service; and the areas of knowledge refer to the variables that allow the scope of a project to be developed within the times, costs and quality required by the client. Although the PMI proposes 5 groups of processes, ten areas of knowledge and 47 management processes, for this case the ontology will focus only on one, “The creation of the EDT”, taking it as a hierarchical decomposition, oriented to the deliverable product of the work that will be executed by the project team, to achieve the project objectives and create the required deliverables “. The ontology will be able to resolve questions regarding the WBS, such as: • What is the project identification code? • What is the name of the project to which the WBS belongs? • What is the name of the management organization responsible for the execution of the project? • What is the management organization responsible for the sponsorship and / or contracting (client) of the project? • What is the start date of the project? • What is the date of completion of the project? • What is the EDT version? • What is the date of preparation of the WBS? • What is the responsible author of the WBS? • What are the phases that make up the WBS? • What are the work packages of the WBS? • What is the initial phase of the project? • What is the final phase of the project? • Which (are) the milestones of the WBS? • Which (are) the predecessor phases of a phase? • Which (are) the successor phases of a phase? • What is the identification of a work package? • What is the start date of the work package? • What is the end date of the work package? • What is the purpose of a work package? • What are the deliverables of a work package? • Who is responsible for the work package? • Which (s) interested parties participate in a work package? • What is the duration of a work package? • What is the cost of a work package? • What is the version of the work package? • What are the risks associated with the work package? • What (s) acceptance criteria are associated with the work package? • What are the assumptions associated with a work package? • What (are) the restrictions of a work package? • What (s) are the resources associated with a work package? • Which (are) the predecessor work packages of a work package? • Which (are) the successor work packages of a work package? • What are the milestones associated with a work package? • What activities are associated with a work package? • What are the changes associated with a work package? • What is the value of the performance indicator that is recorded in the work package at a given moment in the project?
Sources of Knowledge	- PMBOK® 6th Edition Guide

Source: The authors

Table 38. Glossary of terms

Name	Synonymous	Acronym	Description	Type
Structure of Breakdown of	EDT	WBS	The Work Breakdown Structure is a hierarchical decomposition, oriented to the deliverable product of the work that will be executed by the project team, to achieve the objectives of the project and create the required deliverables.	Concept
Project code	IDProject		Identifier that allows differentiating one project from another.	Instance attribute
Project			Name of the project to which the WBS belongs	Concept
Executing Organization			Organization responsible for the execution of the project	Concept
Contracting Organization	Sponsor		Management organization responsible for the sponsorship and / or contracting (client) of the project	Concept
Elaboration date			WBS Preparation Date	Instance attribute
Start date			Date that is estimated for the start of the project	Instance attribute
End Date			Date that is estimated for the completion of the project	Instance attribute
Version			EDT version number, according to its modifications from the first proposal	Instance attribute
Author-Responsible			Se refiere al autor y responsable de la EDT	Concept
Fase			It is considered as the first level or the highest level of breakdown that is given to the overall structure of the project.	Concept
Phase Identifier			Identifier that allows you to differentiate one phase from another.	Instance attribute
Work Package			It is considered as the most specific or lowest level of breakdown of the WBS.	Concept
Work Package Identifier			Identifier that allows you to differentiate one work package from another.	Instance attribute
Milestone	Milestones		A milestone is a zero-duration task that symbolizes having achieved an important achievement in the project.	Concept
Milestone Identifier			Identifier that allows differentiating one milestone from another.	Instance attribute
Predecessor phase			It refers to the phase that precedes a certain phase.	Instance attribute
Successor Phase			It refers to the phase that is programmed after a certain phase.	Instance attribute
Date Start Work Package			It refers to the date that is estimated for the start of the Work Package.	Instance attribute
Completion Date Work Package			It refers to the date that is estimated for the completion of the Work Package.	Instance attribute
Stakeholder			It refers to any type of interested party that has to do with the work package, either as responsible or participant. (See ontology of Interested)	Concept
Deliverable			It refers to the final product generated by the work package.	Concept
Duration Work package			It refers to the amount of time that is estimated for the total execution of the work package.	Atributo de Instancia
Cost Work package			It refers to the amount in budget that was invested in the work package.	Instance attribute
Work package version			Identifier that references the number of changes that the work package has registered.	Instance attribute
Risk Work package			It refers to the event that can positively or negatively impact the work package in its execution.	Concept
Acceptance Criteria Work Package			These are the minimum requirements with which the work package must comply with in its execution and deliverable in order to validate itself as accepted.	Concept

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Table 38. Continued

Name	Synonymous	Acronym	Description	Type
Assumption Work package			Are the aspects that are counted as true and valid before the execution of a work package, which is supposed to contribute to the success of it.	Concept
Restrictions Work package			Are the aspects that are counted as true and valid before the execution of a work package, which is supposed to be a reason for obstacle or limitation for the same.	Concept
Resource Work package			These are all the resources that are associated with the execution of the Work Package.	Concept
Predecessor work package			It refers to the Work Package that is scheduled to be executed before the package in question.	Concept
Successor work package			It refers to the Work Package that is scheduled to be executed after the package in question.	Concept
Activities			Son las acciones que hacen posible el desarrollo de un paquete de trabajo.	Concept
Quality criterion			They are the minimum quality requirements that support validation of acceptance of a work package.	Concept
Change Work Package			These are the adjustments that have been applied to a work package before, during and after its execution and that altered its initial planning.	Concept

Source: The authors

Based on the proposals found and the opinion of the group of experts, a common and used tool for planning and management of the scope is the Work Breakdown Structure (WBS), taken as a hierarchical decomposition, oriented to the deliverable product of the work that will be executed by the project team, to achieve the project objectives and create the required deliverables. Organizes and defines the total scope by subdividing the work into smaller and easier to handle work portions, called work packages, which can be programmed, financed, monitored and controlled (PMI, The PMBOK® Guide (Spanish)). Due to the recognition of its effectiveness and the importance it has gained with respect to this management process, this article proposes an ontology model in the domain of project management with the PMI approach, in the management knowledge area of scope, in the planning process, specifically applied to the process of creating the WBS.

Specification

This consists of constructing a specification document that includes the domain to which the Ontology refers, the date on which development begins, who are the developers, what is the purpose, what level of formality will the Ontology reach, its scope specifying the questions of competition and what will be the sources of knowledge. See Table 37. Requirements Specification Document - Ontology Management of WBS.

Conceptualization

This stage consists of organizing and converting an informal perception of project management in the area of knowledge of the administration of interested parties into a semi-formal specification using a set of intermediate representations (tables, diagrams) so that they can be understood by the managers of projects and their work team. This phase is composed of 11 tasks, which are developed below:

Task 1: Build the glossary of terms. The glossary of terms is the definition of all the relevant terms of the administration of interested in the management of projects (concepts, instances, attributes, relationships between), their descriptions in natural language, their synonyms and acronyms. See Table 38. Glossary of Terms. Source: The authors

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KEY TERMS AND DEFINITIONS

Change: It refers to the adjustments requested by the Stakeholder to any aspect of the project at the management level or its objectives.

Concern: Value or utility that the Stakeholder has on the project.

Cost Unit: It is the amount of money that the project costs the stakeholder's participation in the life cycle project.

Event: Situation, circumstance or reason that makes difficult, impossible or facilitates the development of an activity during the life cycle project.

Influence: The quality that grants the ability to exercise control over power by a Stakeholder in the life cycle project.

Impact: An affectation level that can generate a Stakeholder to make changes to the planning or execution of the project.

Ontological Engineering: Engineering dedicated to the set of activities concerning the development process of ontologies, their life cycle, the methods and methodologies to build them and the tools and languages that bear.

Ontology: Set of terms of knowledge, which includes vocabulary, relationships and a set of logical rules and inference about a particular domain.

Performance: It is the result of the efficiency and effectiveness analysis that a stakeholder had of the activities to which the stakeholder was assigned or participated in some way during the life cycle project.

Power: Authority level of a Stakeholder during the life cycle project.

Project Management: Is the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements.

Requirement: These are the organization's needs and wishes in relation to achieving the project, or the solutions that will make it possible to achieve these goals.

Risk: It is an uncertain event or condition that, if it occurs, has an effect on at least one of the project's objectives. Objectives may include scope, timing, cost and quality.

Role: Role or function of the Stakeholder in the project.

Stakeholder: Person or group of people or entity that can affect or be affected by a decision, activity or exit from the project.

Strategy: Set of actions aimed at well-being and good organizational environment, during the life cycle project

Time Unit: This is the amount of time that the stakeholder participates during the life cycle project.

Working Package: A working package is a quantitative and qualitative description of an operation to be carried out in the project, known as the lowest level of EDT decomposition.

Chapter 14

Adopting Communications Management Practices in Project Management: A Preliminary Study in Bogotá, Colombia

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ABSTRACT

This chapter deals with the adoption of communication management practices applied by project managers in Colombia. It has become a priority in project management practices in the past decade, but the research field and knowledge domain has seen limited empirical evidence. Therefore, it verifies the influence of the application of these types of practices against performance indicators obtained in projects. To carry out this preliminary study, leaders of companies from different sectors of Bogotá in Colombia were interviewed under a mixed-methods approach. It was verified that the practices currently applied have a low adoption rate, but they are influential for achieving success in project management and highlight the importance of these types of techniques for the performance of the planned work. This study aims to generate the option of applying unconventional approaches to manage communication in projects that allow for improving performance rates in companies.

INTRODUCTION

Currently the methods used to resolve problems associated with managing (or administering) projects in

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organizations are based on work practices that focus on different areas of knowledge (Dow & Taylor, 2008). These seek to organize all efforts required to achieve the objectives of the project, under the expected performance requirements of each stakeholder (i.e. sponsors, beneficiaries and project governance). The typology of these factors is diverse, some professional associations and large organizations have generated guidelines for grouping these elements in order of priority; these elements can therefore be taken into account to develop the systems, or management methods, under which they should 'manage' the project in an organization. An example of this is the Project Management Institute (PMI) framework, and project management body of knowledge (PMBok, Project management body of knowledge) (PMI, 2017), as well as the methodological commitments within the project cycle (Fortune et al., 2011; Ika et al., 2010; Morris et al., 2006 ; Díez-Silva et al., 2012 ; Rubiano & Cuadros, 2012 ; Verdugo & Salazar, 2012).

One of the factors and main objectives of this research paper is to study communications management in projects. It has become a priority in project management practices in the past decade, but the research field and knowledge domain has seen limited empirical evidence. In spite of this, various studies have been conducted in different contexts; communication factors or communications management in projects, have become a priority for the execution and guaranteed success of projects by project leaders (Mayer, 2010; Uribe, 2008; Zulch, 2014). This gives rise to the main research problem, which is focused on determining the degree of influence communications management has on the success of project management, first by establishing the way leaders leverage the applications and tools.

Based on the above, and with the purpose of contributing to the "Project Management" body of knowledge, this research paper aims to describe all the communications management practices currently used and implemented by project managers in Bogotá (Colombia). In turn, the empirical evidence will help to structure a methodological application plan that can be incorporated into the project teams work scheme.

BACKGROUND

In the specific field of communications management and project management contexts, there is insufficient empirical evidence found dealing with the application of projectized plans (Reith et al., 1995). However, authors such as Mayer (2010), Uribe (2008), Benita (2014), Reybal (2012), agree that the management of communications is the responsibility of the project leader. It is also important that these leaders create communication plans that incorporate technologies and good practices to ensure that the information is delivered on time and to the appropriate audience.

Therefore, the effectiveness, efficiency and consistency of communication in a project depends on who is leading. Also, the communication objective must be aligned with a process; providing the project with the necessary dynamism, to illustrate the scope of limitations at the appropriate time in each stage. Thus, making the right decisions to maintain the objective and leverage the project, if it is required, Leung (2010), Martínez (2006).

However, sources recommend that the project manager, in addition to being in charge of the management of resources, and the success of the project, must have communication skills that allow them to accurately manage each situation that arises in order to avoid the failure of the project. It is also considered that, by assuming this position, the rest of the work team may be excluded, however it is clear that if everyone possesses the same skills, the effectiveness of the communication process will be achieved and a successful project will be executed. Benita (2014) states that a work team and the organization benefit from sharing the vision of the leader in a project and their communicative skills can be tested. Therefore,

Adopting Communications Management Practices in Project Management

regardless of who is responsible for the communication management in the project there should be a focus on the people, their skills and competencies and investing in a team that is highly engaged and in constant communication (Fay 2003, 2004).

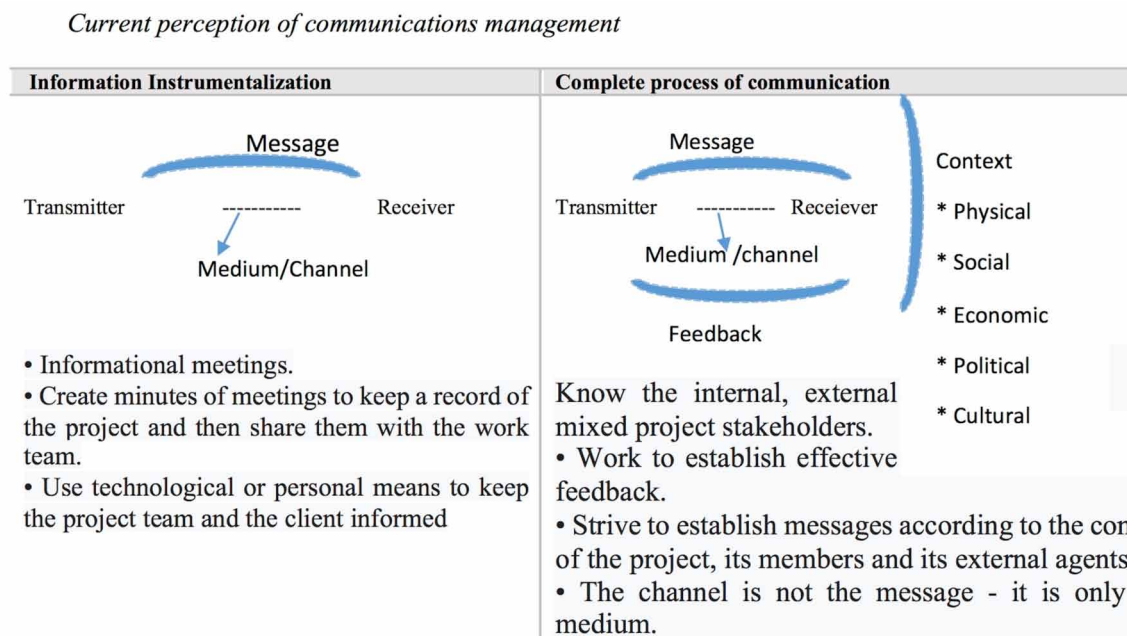
In the current literature we observe that the communication process is considered only from an instrumental perspective, and not from a process perspective, which means that the inputs, activities and outputs lead to decision making process (see figure 1).

Now, understanding communication from an instrumentalization perspective means that responsibility for the effectiveness of communication lies with the medium or channel. It is believed that if an email is sent with an attached record, it is sufficient to assume that communication is being managed appropriately. However, although e-mail has become one of the most used forms of communication, it is not the most effective. Email is used and considered sufficient for the management of communications in projects but as McLuhan (2012) established with his Tetrad and Scolari (2015) in his text 'Ecology of the media', email is considered a cold medium. The receiver of the email message does not have an efficient and effective feedback option, because he must play with his imagination in terms of tone, intention and the clarity of the message sent or recorded. This corroborates what was expressed by Mayer and Margery (2010) "in many cases the responsibility of communications management is left to technology which can fail and this means that the best tools and technologies can not guarantee quality communications. Concessions must be made to ensure that good communication practices are implemented to deliver effective messages according to the objectives initially set. It is the combination of technologies and quality messages that allow for communication success."

When an organization has as a project management issue, it must not only carefully choose the project leader and team, but also determine the appropriate communication needed between the parties

Figure 1. Current perception of communications management

Source: Authors' own elaboration



of interest. Therefore, it is advisable to take special care in understanding media, not only as those who are involved in the communication process and are part of the channel. And all the ways in which the recipient will understand and face each of the stages of the project, in view of their responsibilities.

Therefore, communication should not be seen as an empty instrument but as the “glue” that contributes to the project being successful. For this reason, the leader should feel that the project is a burden but an activity that flows and is secure; the proper communication management in projects contributes to a large percentage of the project being under control.

According to existing literature, communication within project management is not assumed as a process but as an activity responsible for the information log and the memory of the project. However, this is far from what it really seeks, if you consider the guidelines generated by the Project Management Body of Knowledge (PMI, 2017) as the implementation of a true process of communication.

This research paper aims to document and present some of the main communication management practices in projects related to what the project leader knows about communication processes, skills and competencies. This, in addition to the scarce evidence that exists on how to actually manage communications from the process perspective and not from the instrumentalization of communication, through tools that can be ineffective and repetitive, which leads to moving away from the dynamics of actual involvement within a project regardless of its size and geographical location.

STUDY METHODOLOGY

The research work has been developed under a mixed approach, with an exploratory and descriptive, non-experimental transversal scope (first half of 2018). In the first stage of the study, empirical evidence in the field of communications management in project management was collected and reviewed. The bibliographical review shows that evidence on this specific issue is scarce, inconclusive, and lacks a rigorous approach. Based on the first results and the empirical evidence of the literature review, an instrument for the second phase of the study was developed (see table 1). It was applied to different project leaders from organizations in the city of Bogotá in Colombia. The variables were defined based on communication management techniques that can be applied within an inclusive and effective context, as well as variables indicating the success of the project according to the use of these techniques.

The instrument used for the second stage of the study, was validated through the use of Cronbach's Alpha. A tool that measures the correlations between the variables that are part of the measurement. Usually, validity is defined based on the variances (Cronbach's alpha) or the correlations of the items (standardized Cronbach's alpha), Wackerly (2008). Therefore, and as stated by Howard Wainer, Henry I. Brau “(...) Cronbach's alpha or the coefficient allows to evaluate the reliability of each item and thus exclude or include the items that maximize the reliability of an instrument for a particular subject”(Howard Wainer, Henry I. Brau (2009))

According to this tool, to achieve the appropriate degree of reliability with a particular instrument, the index must not exceed the scale of 1 - both in its individual items and in the instrument in general. After reviewing the 12 items of the survey applied in the second stage of the study, a score of 0.90 was obtained for the instrument in general, and an average of 0.818 for each of the questions, as shown in Figure 2.

Table 1. Technical sheet of the applied survey

Requested by	Research Group in Management & Project Management, Research Group in Linguistics and Organizational Communication
Realized by	Co-researchers of the Research Group
Name of survey	Adoption of Communications Management practices in Project Management.
Universe (Potential market)	Leaders of organizations that apply project management methods or processes in their daily work.
Sample units (citizens, companies)	Companies in Bogotá that have designed a methodology to manage their internal projects.
Date created	2018-11-04
Coverage	National
Data collection technique	Survey directly applied in each of the organizations with the personnel in charge of project management
Survey objective	Establish a typological framework of methodologies that have been designed to manage projects in Colombian organizations
No of questions formulated	Total, questions: 12. • Part I: general information – 8 questions. • Part II: Adoption of practices – 1 question with 22 practices. Part III: 3 questions.
Types of questions applied	Closed 11, Open 1
Scale used for measurement	Binary and semantics

Source: Authors' own elaboration

ANALYSIS OF RESULTS

For the analysis of the results, based on the application of information collection tools, the perception and work in communications management of project leaders from the city of Bogotá was taken as the field of research.

With respect to the information collected, and the use of standards or knowledge frameworks for project management, it can be said that the proposal of the PMBoK in its sixth edition is the one most desired by different leaders. One of the reasons for this adoption is that there is limited additional information that is practical and accessible for project leaders in communication management issues. It is important to clarify that those who carried out this research consider that the management model proposed by the PMBOK, is insufficient, since it takes on the perspective of the instrumentalization

Figure 2. Instrument validation

Instrument validation

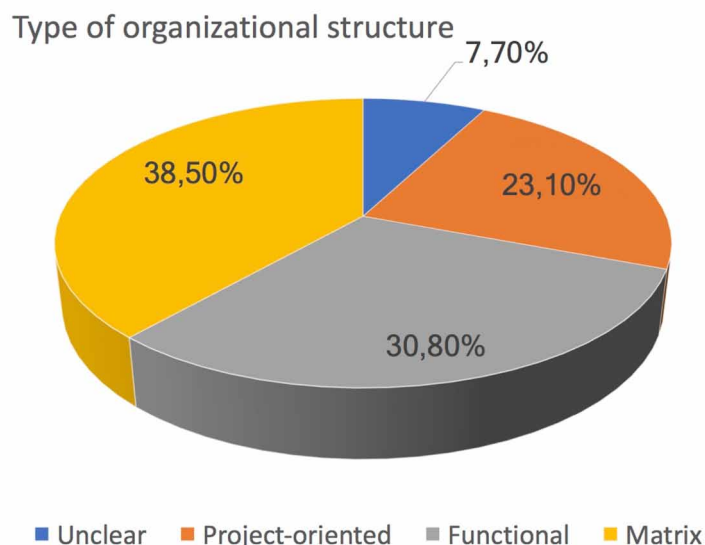
Reliability statistics		Reliability statistics	
General survey		Items	
Alfa of Cronbach	No of elements	Alfa of Cronbach	No of elements
,902	12	,818	12

of communication. Relying on the channel for transmission of information, and not on the process from the construction of a communication strategy that considers the different communication variables such as, the stakeholders, the communication contingencies of the project, the conditioning factors of the strategy and the measurement variables of the communication process to ensure the effectiveness and efficiency the during project management. Below, you will find a brief analysis of the results obtained in each chart (Figure 3).

Whilst it is evident that most of the project leaders that responded to the instrument proposed in the research belong to a matrix organizational structure, it could be assured that this type of structure would facilitate the exercise of communications management. However, for this to happen, it would be necessary to identify whether it is a strong, weak or balanced matrix, as defined by Minsal (2007). If it is a balanced matrix-like organization, communication management can be efficient without being one hundred percent effective from the point of view of the instrumentalization of the use of tools associated with the channel in the communication process.

On the other hand, the second highest percentage belongs to functional type companies, indicating that due to its focus and structure the most important type of communication in these organizations is

Figure 3. Type of organizational structure of the organization



Adopting Communications Management Practices in Project Management

the cascade which is delivered at each level with the same feedback. This could generate problems with communications management in projects if you do not have a clear and defined communication strategy.

The respondents who were part of the study, as indicated in Figure 4, mainly execute projects on infrastructure, of which 25% of the companies are of the matrix type, the additional 25% have the project-oriented approach and the remaining 50% are functional. This is consistent with the results from the use of tools and techniques that will be seen later and from a communications point of view since as seen in the previous chart, a higher percentage of companies with a functional approach means communication is not as fluid as it is expected for the proper management of a project.

It is important to recognize that, as seen in Figure 5, organizations formalized project management, which becomes an opportunity to provide from research processes that contribute to the proper management of communications in the projects. In this sense, it is also important to analyze that the formalization of project management in organizations, or attempts to do so, allows the implementation of changes in applied practices, as in the case presented in this research, to improve the performance of the projects through changes in the communication management knowledge area.

Regarding the application of project management in general, as can be seen in Figure 6, the results of this question are coherent with the previous ones, given that project management is increasingly formalized. It is clear that the practices are not yet one hundred percent standardized, which is not entirely negative because when managing communications appropriately from communication strategies and not only from tools, a greater impact is achieved on the objectives set in each project.

As mentioned before, these results (see Figure 7) show that the most adopted methodology is the the adapted PMBok, followed by the same methodology “Own methodology” that is based on isolated communication activities. Both, the former and latter show that there is no clear or defined communication strategy, which does not prevent communication flow. However, if it is not structured you can not

Figure 4. Type of projects executed by the organization

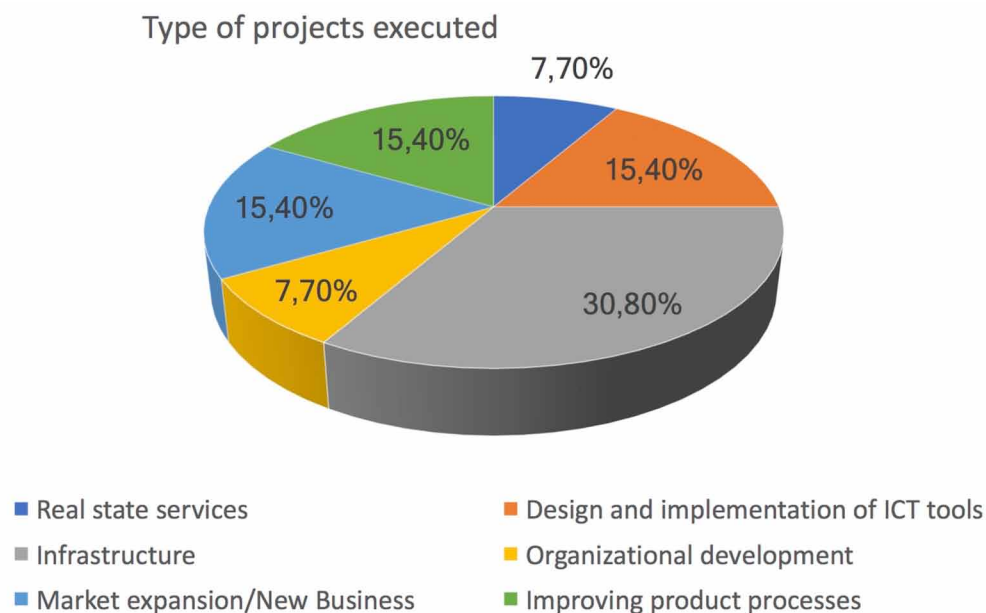
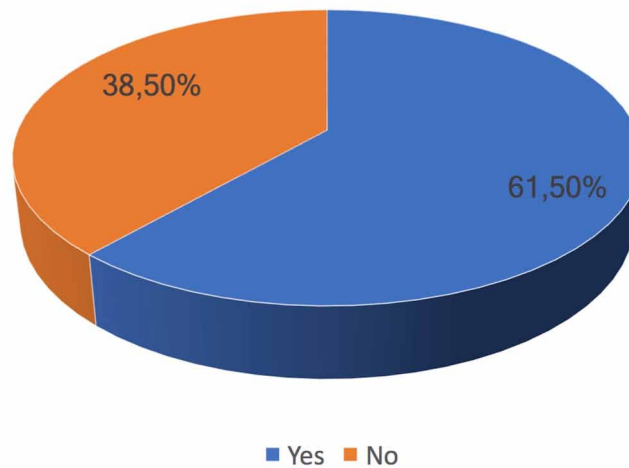


Figure 5. Formal structure for project management in the organization

Formal structure for project management



measure and control the element that makes your contribution minimal compared to what can be achieved in terms of communications management in projects. In conclusion, the possibility of improvement in these types of practices can be used, in order to look for better performance for projects undertaken in organizations.

As shown in figure 8, the responses obtained support what was observed in the previous graphs; cold forms of communication such as minutes, meetings, emails, followed of chats and intranet are considered

Figure 6. Application of Project management prcatices in general

Application of PM practices

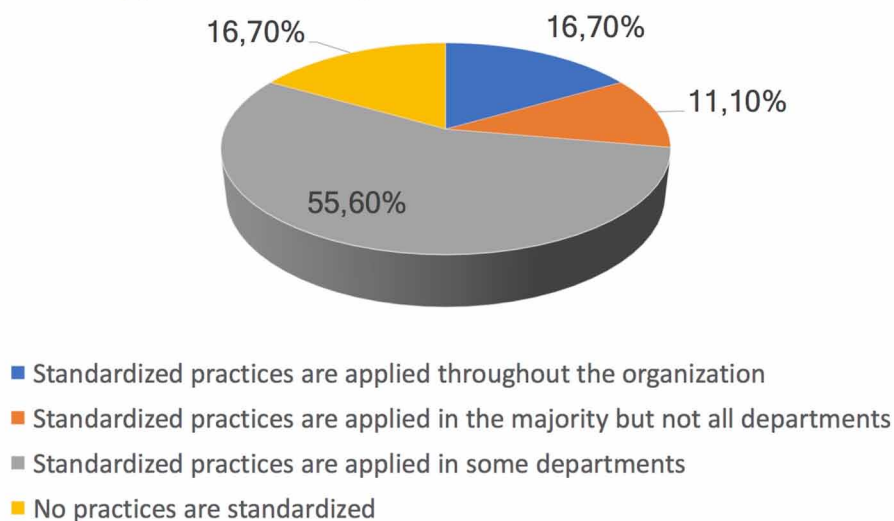
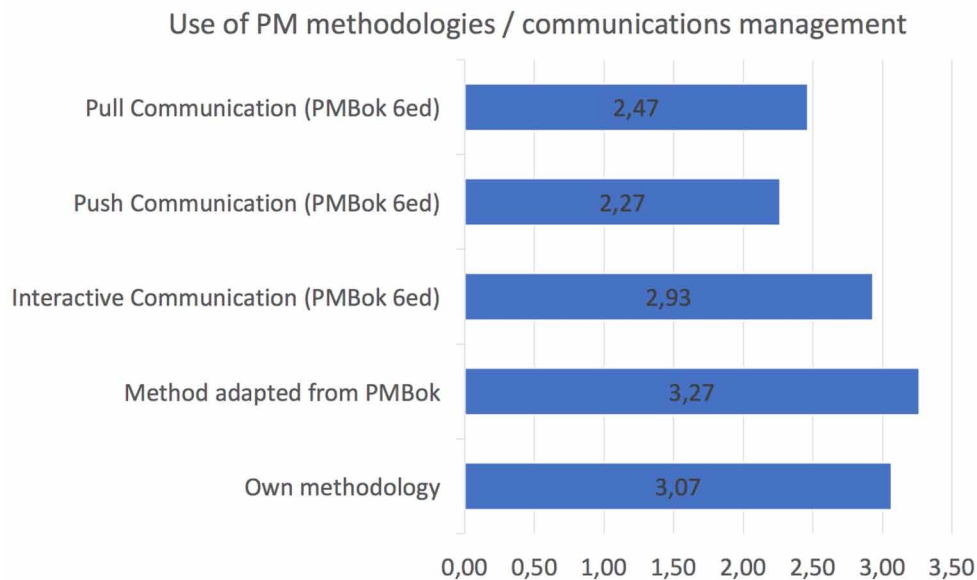


Figure 7. Use of project management methodologies with a communications management approach

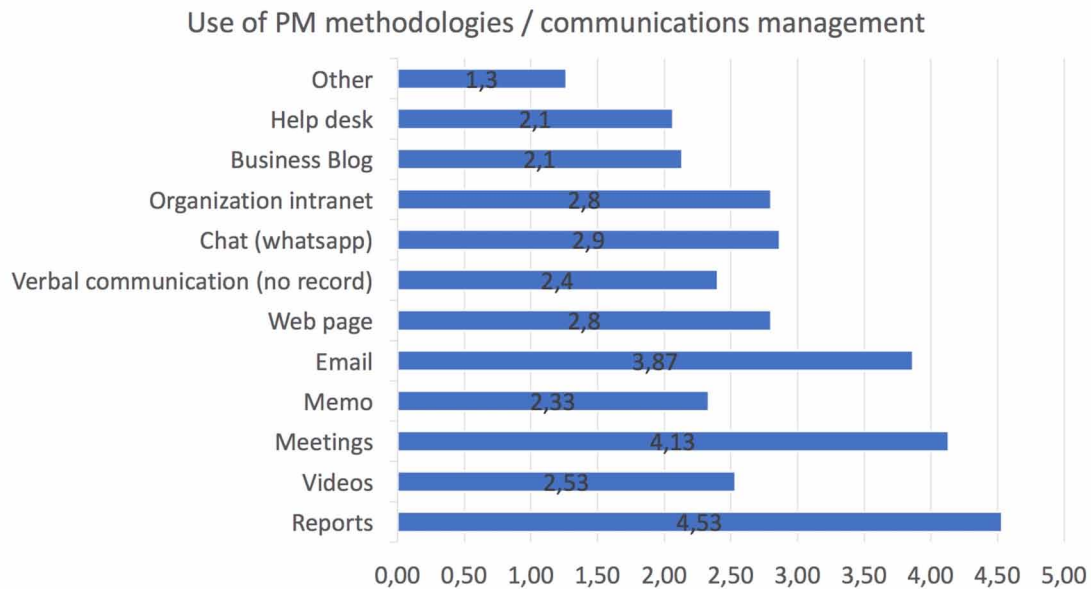


suitable techniques. These techniques are based on the channel (used in the communication process) and do not adapt to different stakeholders, particularly since they share the goal of providing information without waiting for feedback, and it is not consistent with what a real communication process seeks. In that sense, the possibilities of developing strategies with greater impact in terms of communication, in the case of the management of project communications, generate a field of support that can be very useful for project execution. Which can be designed looking at the performance criteria for stakeholders and sponsors and changing the paradigm that communication management applies from the perspective of process and strategy, all techniques should be equal in their selection, use and preference.

When organizations base most of its operation on projects, communication must be understood as one of the main tools to ensure that the objectives are traced in each one of the projects. The results on this chart (see figure 9) show that 100% state to have their own internal software, which corresponds to 53% of respondents, 23.8% have a matrix approach; 15.3% are project-oriented and the remaining 15.3% are functional. This is in some way consistent with the responses in the previous items where it shows that companies are increasingly organized in the structure of the departments and the company itself to assume, project and manage projects. However, there is still a high percentage in which the communication management is not sufficient and efficient from the perspective of the strategy and not through the use of isolated tools to transmit information.

In the last part of the study, a preliminary cross-sectional study was made between the use of processes, techniques, or communication management tools with the result of taking the performance of the projects executed by the organizations that were part of the study. To finish the study, the questions that illustrated the research work, related to the impact that the use of these elements can have in improving the performance of the projects in terms of their success criteria were considered. Figure 10 and Figure 11 show the results, presenting the groupings for each performance criteria and the clusters according to each success percentage within that criteria, and the results for global project performance.

Figure 8. Adoption of communication management techniques in projects



With the crossing of variables, it can be shown that in terms of performance criteria such as deadlines, costs, satisfaction of beneficiaries there is no positive relationship from the use of communication management elements, because in general very few projects have good results in those criteria, with an 81-90% success rate, but only in a minimum group of projects. For the satisfaction criteria of the project team,

Figure 9. Adoption of communication management tools in projects

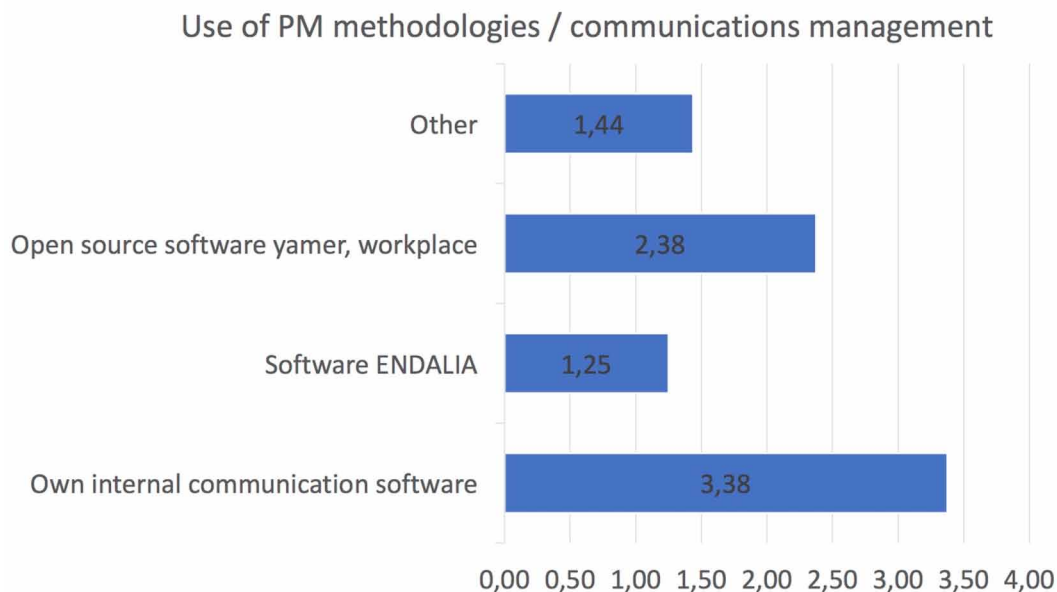
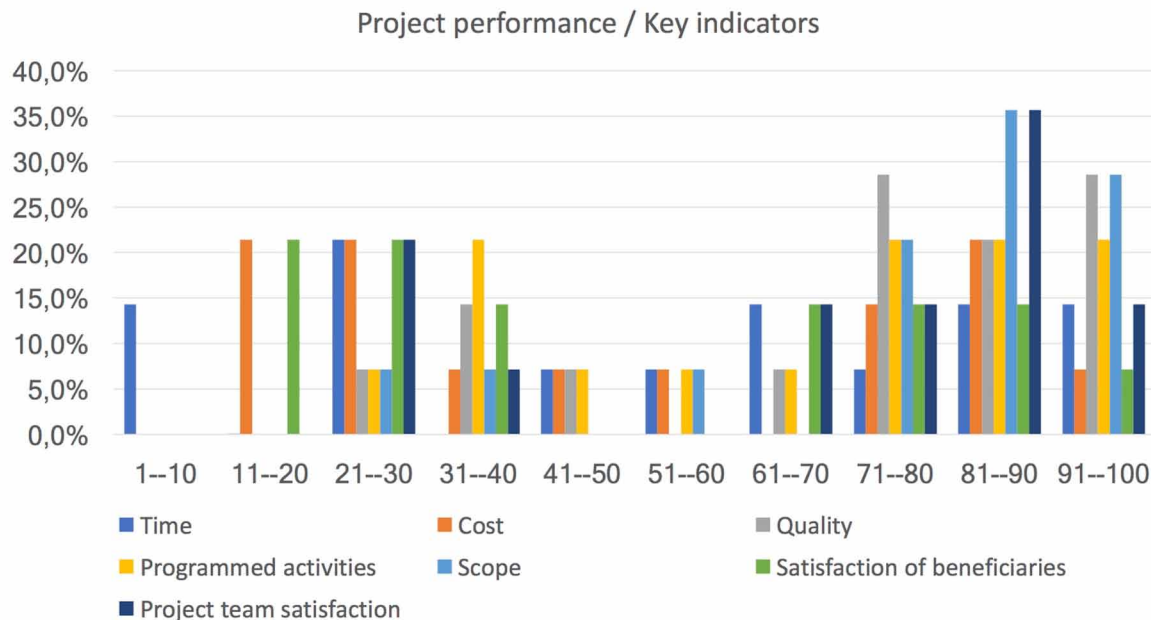


Figure 10. Results for key indicators project performance



a different trend is presented, although there is no evidence of a high impact, the results in this criteria are better in terms of grouping, because the performance rates improve with the number of projects.

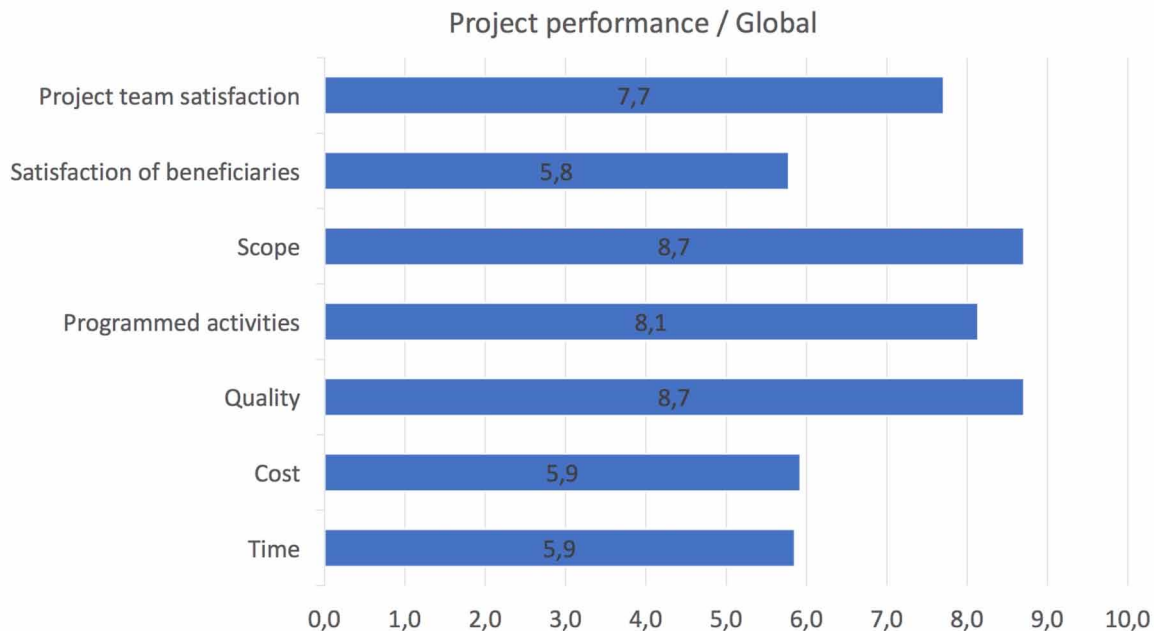
Finally, there is a positive relationship between the use of tools, techniques, and communication management processes and the criteria of quality performance, programmed activities and scope, because grouping rates are less dispersed and results in terms of performance are much better than in the previous cases. This generates the preliminary hypothesis that indicates the use of these types of elements impacts the criteria that has the greatest incidence on the execution of the project (quality, activities, and scope). There is a preliminary evidence not described in previous literature, which will generate a robust hypothesis for a future study, based on the impact of the use of communication practices as an effect on the execution of a project, and on performance indicators. that usually are not considered as effected by these types of practices.

CONCLUSION

This research presents an analysis of the relationship between the use of communication management practices (techniques, processes, and tools) on performance criteria for project management (deadlines, cost, quality, activities, scope, satisfaction of beneficiaries, and satisfaction of the project team), with the purpose of verifying the criteria in which there is a greater impact when using the mentioned communication elements.

According to the results obtained, in Bogota companies that responded to the questions, used different tools, techniques and methodologies that are mostly detached from a communication strategy for communication management in projects.

Figure 11. Results for global project performance



One of the reasons why communication is managed without an instrumentalized perspectives, is because there are great gaps both in research and praxis to handle communication management in projects.

The only method known, recognized and implemented is that of the main sources of authority in projects, such as PMBok, which advises in terms of communication management. It is clear that the responsibility for the effectiveness and efficiency of communications in projects is left to the project leader.

It is wrongly recognized that tools, techniques and methodologies in terms of communication management in projects, should be applied in isolation. It could be due to this reason that what is used, in relation to techniques, only allows for the transmission of information in order to document and preserve the memory of the project, but not with the intention of obtaining feedback and enabling real communications adjusted during management.

It is considered that when an organization, which focuses its know-how on project management and has a matrix or project-oriented approach, the use of activities in communication processes can become much more efficient. This is because tools are combined, methodologies and techniques that, if framed in a communication strategy, could become more efficient in the management of communication in projects.

It is important to consider, that in future research we are going to propose a methodology in terms of communication, which allows project leaders to access it easily and intuitively. Additionally, it can be tested to corroborate if it achieves greater effectiveness and efficiency in the projects when the communication is managed from the process and not from the isolated tools or techniques -from the instrumentalization of the communication management. Thereby, improving the performance in the number of projects.

The performance criteria for the execution of projects that are most affected by the use of communication management practices are the quality, the programmed activities and the scope of the project, which in turn generates a direct effect on the performance of the project in general. Especially in terms of its execution, since they are the most important criteria when measuring the work that is actually

done on what is expected and planned. In this sense, the results presented here allow us to show a positive contribution in terms of new empirical evidence on an area of knowledge, such as communications, usually not considered in terms of performance in projects, but which can be very useful in the use and management of effective project management practices.

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KEY TERMS AND DEFINITIONS

Communication: Natural and social process in which at least two actors participate (sender-receiver) and are involved in organizations, which becomes an essential element to achieve organizational efficiency and effectiveness.

Communication Methodologies: In the methodologies, the use of communication protocols based on communication tools are analyzed, so that it can be applied in an organization with particular characteristics.

Communication Models: Communication schemes used in a particular way in each organization. You can present formally established models through internal regulations, or informal ones that are valid based on day-to-day life and the effectiveness within the company.

Communication Tools: These are the mediums or channels used to transmit information such as email, memos, billboards, web pages, blogs, press releases, etc.

Communications Management in Projects: Application of communication methodologies and tools to inform the activities, setbacks and decisions during the execution of a project.

Project Management: Applies appropriate methods, techniques, and tools to organize the activities of a project, and to achieve its objectives.

Project Management Methodologies: Comprehensive management system that organizes the processes required to direct the projects in an organization.

Project Management Processes: A set of activities that allow to start, plan, control, and close, the life cycle of a project.

Chapter 15

Conflict Management in International Cooperation Project Teams: Perspective of a Project Manager in Colombia

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ABSTRACT

The complexity of projects of international cooperation (IC) and especially the characteristics which are similar to those of social, international projects in the public sector, and the amount and diversity of the interested parts, makes it necessary to implement strategies when handling conflicts in order to maintain the project according to the established plan and get benefits based on its objectives. This empirical cross-cutting research has as main objective to identify the conflict management process in project teams of international cooperation in Colombia and determine the great influence observed in the style of handling the conflict on the performance of the project. The results showed that the cooperative and collaborative styles are significantly and positively related to the project performance whereas competitive and evasive styles affect significantly and negatively the performance of the project of international cooperation in Colombia.

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INTRODUCTION

The international aid can come from initiatives that offer immediate help to population affected by natural disasters or situations of social or political instability, the projects of International Cooperation the (IC) generally try to give sustainable and long term solution to social problems such as lack of education or need to cover health services in developing countries, all this with the aim of improving the quality levels of life in a part of its inhabitants (Golini & Landoni, 2014).

The international cooperation projects are the most useful tools by governments to help countries with different needs, especially in the human development area. The donor countries, have different ways to finance and cooperate with the International Cooperation projects, for example, by means of bilateral agreements with the governments of the beneficiary countries or with an intermediary, which could be a Non Governmental Organization (ONG) (Golini, Kalchschmidt, & Landoni, 2015). For Colombia, this financing way is the most frequent.

Due to specific characteristics, the International Cooperation projects are more complex compared to the ones of other sectors like construction or the one of Information Technologies (IT), turning this kind of management into a great challenge for the professionals and organizations which are in charge of its formulation and implementation (Khang and Moe, 2008; PM4NGOs, 2012; Youker, 2003). The complexity of the International Cooperation projects, means for the project director, among other important aspects, to implement methodologies to handle the conflict no matter its length, and those methodologies can help control the way these interventions can be done.

In spite of the praiseworthy social and environmental objectives that communities in condition of vulnerability can present, and how complex and dynamic to move important amounts of economic resources these communities could be, this kind of help is known for its poor results, in fact, it is said that its failure has become the rule and not the exception ((Ika, 2012; Hermano, López-Paredes, & Martín-Cruz, 2013). However, the study of this poor performance has focused in the effectiveness of the aid and not in the practices of management of these projects (Easterly, 2010). This study focuses on exploring the methodologies of conflict management implemented by directors of International Cooperation projects by analyzing its influence in the performance of it.

The conflict management in the theory of *Project Management* is not a new concept, for example, (Kwak & Anbari, 2009), identify it in the knowledge area of the management of human resources arguing that it is framed in aspects related to the organizational structure and the organizational dynamics of the project that deal with the abilities of the director of the project like leadership and the ability to motivate his/her team. Also, other authors such as (Díez-Silva, Pérez-Ezcurdia, Gimena Ramos, & Montes Guerra, 2011; Fortune, White, Jugdev, & Walker, 2011) justify the deep study of conflict management in project teams like a factor that can influence the success of the projects.

In spite of the coherence of the study of conflict management with the present and future perspective of *Project Management* and the need to consider the research of the high rate of failure in the performance of International Cooperation projects, all the scientific literature related to the conflict management in this complex topic is not enough. That is why this study tries to contribute to fill in this gap. The objectives of this research are oriented to identify the process of handling conflicts in International Cooperation project teams in Colombia and to determine the existence of significant influences among these characteristics and the performance of the project. The results of this research are important for international aid financial organizations that want to help in the conflict, for ONGs that intervene in the CI, for project directors, and researchers of project management.

This chapter is divided into four sections: the first one presents the general context of the research by means of a revision of Literature focusing on the basic topics of the research such as the management of International Cooperation projects and the management of the conflict project teams. The second section describes the methodology that was designed and implemented by the authors to reach the objectives and to guarantee the validity and reliability of the results. The third section presents and talks about the results obtained from the application of instruments that collected information, based on the planned objectives and; finally, the fourth and last section concludes with the findings and explicit the limitations of the research.

BACKGROUND

Several authors (Pinto, 2018; Morris P., 2011; Shenhar & Dvir, 2007) locate the formal existence of Project Management as a formal and recognized discipline, towards the middle of the 20th century, due to technological advances and of engineering emerged mainly in the military and defense sector of the United States during the period of the Second World War and in later years. Subsequently, in the 1960s and 1970s, with the conquest of space through the Apollo missions and other NASA activities, the project management had a significant advance in order to deal effectively with these megaprojects (Hughes, 1998).

In the last decades the discipline has had a rapid expansion in terms of scope and impact, a fact attributed to the emergence of professional associations of the Project Management in several countries, which have tried to standardize methodologies under the assumption that they are effective for most of projects in all sectors and environments (Morris P., 2013), as proposed by the PMI. According to Ika and Hodgson (2014), this approach to the generalization and standardization of Project Management reflects its origin in the bases of engineering, however, according to these same authors, the discipline navigates at a crossroads between specialization and fragmentation to address sectors where the contexts in which projects are implemented have distinctive characteristics.

When analyzing the Project Management in the international cooperation sector, they are parallel with the evolution of the Management of conventional Projects. For example, International Cooperation also appears in the decade of the 60s and since its inception the sector has been characterized by the fact that a large part of development aid has been channeled through projects financed by multilateral organizations, and many other organizations governmental and non-governmental organizations (Diallo & Thuillier, 2005). In addition, the Management of International Cooperation Projects over time has been transformed and has been influenced by the three approaches proposed by Ika & Hodgson, (2014).

There are many reasons about why the projects of aid to the development or International Cooperation have been taken into account in the scientific literature and are considered as a more complex and particular kind of projects (Kamrul & Indra, 2010). Thus, the management approach must be different to the ones found in the foundation of knowledge and practical guides done by several organisms or associations of professionals of management projects (Youker, 2003) (Golini & Landoni, 2014). The differentiating elements of the International Cooperation projects, that turn into conflict and complexity sources as well, are described above.

The International Cooperation projects cover almost all the sectors with the implementation of the projects: according to Diallo & Thuillier, (2005) the International Cooperation has as main goal objective to improve the conditions of life of populations in poor countries, by means of the delivery of goods

and services of public use. Therefore, the International Cooperation projects can affect sectors such as infrastructure, agriculture and crop, water and environment management techniques, urban infrastructure, education, health and nutrition, education and training, utilities, transport, etc. Besides covering a great range with the implementation of projects they also have hard and soft components.

Lack of a defined client: This characteristic talks about the power and the roles played by the interested parts which are essential for a CI. Whereas the traditional projects generally have two interested parts - the client and the doer of the project - (Kamrul & Indra, 2010), those of International Cooperation frequently involve at least three interested parts: the financing organism, the organization doer and the beneficiaries. In the International Cooperation projects, the ones who pay for them are the donor companies which are considered interested parts - and not as clients - because the target client is the community of the developing country that will be intervened and that will get benefited from the project (Diallo & Thuillier, 2005). Donor agencies fund and supervise the project to ensure that their expectations are met (Ika, 2012), but they do not specifically establish what the project results will be because the solution is designed with and for the beneficiary community.

On the other hand, the beneficiaries of the community are difficult to delimit and although they are considered as clients, they do not pay for the results of the project and do not have the technical capacity. Besides, they cannot settle down the objectives of the project by themselves, that is why they are weak having them take an influencing role more than the one of a client (Ahsan & Gunawan, 2010). According to Khang & Moe, (2008) this situation is similar to the one of the public projects, where the low power of clients in the supervision and direction of the project, makes other interested parts can influence changes in the initial scope of the project, losing, because of the time, the expected impact in the original design.

And finally, the executor organization, which is generally a nongovernmental Organization -NGO, is in charge of managing the project in order to fulfill its objectives and solve the problem that was the origin of the project. Nevertheless, the team project must consider the community, on which it does not have authority or power, so this team must implement strategies that allow them to obtain their approval and to count on their participation (PM4NGOs, 2012). This complex relation between the interested parts, creates conflicts and it can be one of the main causes of the failure of the International Cooperation (Hernando, López-Paredes, & Martín-Cruz, 2013).

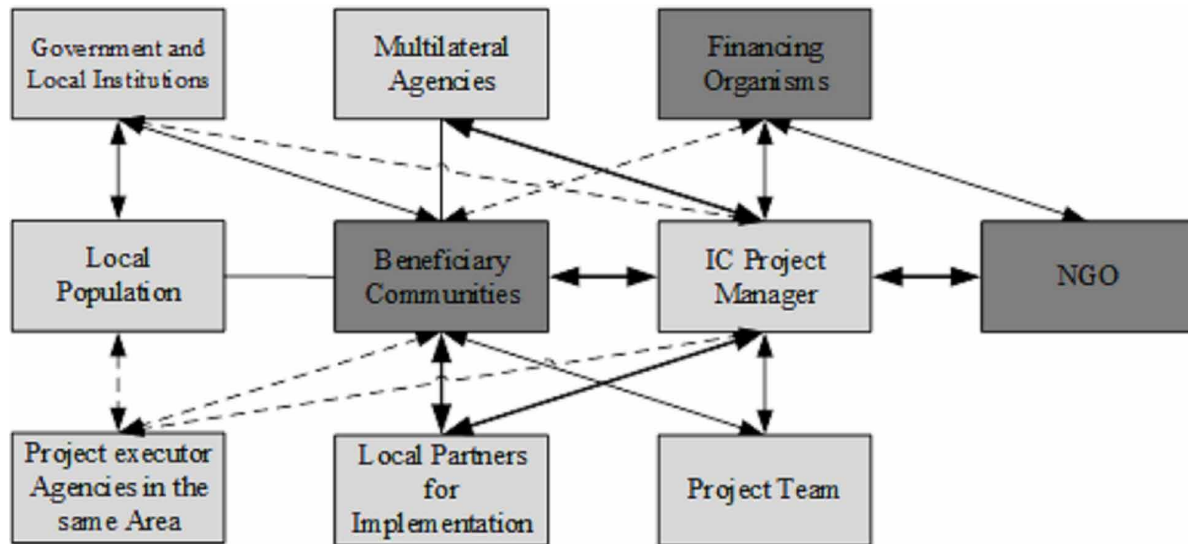
These are projects of the public sector: They are usually adapted to programs and policies of the host country and must face aspects that make it difficult its management such as: political interference and manipulation, including strategic misrepresentation or information on costs, benefits and risks; scrutiny of the media; intolerance to failure; rigid, bureaucratic and cumbersome procedures and; over-optimism, overestimating the benefits to support projects whose low budgets are previously known, in order to obtain political benefits (Flyvbjerg, 2005; Wirick, 2009).

A large number of stakeholders: International Cooperation projects involve a large number of different interest groups, for example, donor agencies, government organizations, civil society and local beneficiaries (Diallo and Thuillier, 2005; (PM4NGOs, 2012) This produces an additional source of complexity that deals with managing conflicts and relationships between different interest groups. Those groups can be strong or weak, direct or mediated, and frequent or rare (Ika & Hodgson, 2014; Golini & Landoni, 2014; Ahsan & Gunawan, 2010), as illustrated in Figure 1.

The dark boxes show the interested parts. The solid lines show frequent communication and the dotted lines show limited communication.

Figure 1. Stakeholders and their relationships in an international cooperation project

Source: Adapted from Golini & Landoni, (2014) and Ahsan & Gunawan, (2010)



Difficult, complex and risky surroundings: Project development tends to operate in exceptionally difficult contexts characterized by high risks, complex acquisition networks political surroundings/ unstable financiers and uncertain conditions (PM4NGOs, 2012). Even more, many times International Cooperation projects operate under difficult natural environments (territory, topography, climate and the risk of natural disasters) (Khang & Moe, 2008). These conditions make this type of projects difficult, complex not easy to manage.

Shortage of resources: according to Golini and Landoni's research, (2014) the organizations in charge of executing International Cooperation projects are generally ONGs, and are marked by their reduced budgets which makes that the project team is often conformed by volunteers. Youker, (2003) has demonstrated the frequent lack of specialized technological infrastructure resources in places where International Cooperation projects are implemented.

Cultural differences: One of the main causes of conflict in projects under geographic dispersion conditions where the stakeholders come from several countries, has been attributed to cultural differences such as values, religion, language, managerial processes and academic level (Rodríguez Cañas, Castro Silva, Díez-Silva, & Montes Guerra, 2013). International Cooperation projects operate in conditions of geographic dispersion. These are international projects in which the cultural factor is enough complex, in terms of forms of local life, institutions, policy, legislation, regulations and norms, customs, practices, languages, time zones, administrative holidays, processes, social forms of hiring, conflicts and availability of resources (Grisham, 2010).

Intangible objectives: The objectives of International Cooperation projects, by definition, are focused on poverty reduction and the improvement of the standard of life, the protection of environment and the human rights, the help of people victims of natural or caused disasters, and the development and construction of physical and social basic infrastructure (Khang & Moe, 2008; PM4NGOs, 2012). These projects are particular because of their social benefit and not for profits obtained by the intangibility of their results (Kamrul & Indra, 2010).

According to these eight particularities of the International Cooperation projects, it is possible to be considered that scientific literature places them as a special type of projects with special characteristics of complexity, although they share features with the conventional projects of engineering, such as having time, resources, quality and scope restrictions. These characteristics of International Cooperation projects make them more difficult to be managed, as expressed by Ika & Hodgson (2014), "IC projects are an extreme case of conventional projects", which must handle extreme characteristics of public and private ones as well as national and international projects."

In this regard, the definition of International Cooperation project proposed by Johnson, (1984) brings the need to use specific management techniques and tools, which does not contradict the content of the Project Management Guide for Professionals of the Development (PMDPro), where the definition of GP for this type of project is the discipline of planning, organizing and managing resources to carry out the successful delivery of the project's objective, products and results (PM4ONGS, 2012). According to this same guide, the Project Management is science and art and includes specific skills for a project manager, which are classified as technical, leadership, or interpersonal, self-management and specific to the development sector as understanding the values and paradigms of the sector, show cultural sensitivity and develop in complex environments, among others.

FOCUS

During the life cycle of a project, conflicts often arise, mainly caused by the different positions of the stakeholders regarding the way to face the obstacles that are presented, the way of executing the tasks of the project and its principles and values (Takim, 2009). As the size and complexity of a project increases, it is normal for a greater number of different stakeholders to intervene, making it difficult to identify and understand the causes of conflicts and consequently implement appropriate strategies and styles for managing it. All this becomes an important challenge for the project manager (Jaffar, Tharim, & Shuib, 2011). International Cooperation projects, when considered as a highly complex type involving a large variety and number of interested groups, must face the difficult task of managing the resulting conflicts during the life cycle of the project.

Research related to conflict management has classified conflict as a characteristic attached to the interactions that arise among team members, typical of all group work activities (Jehn & Bendersky, 2003, Jehn & Mannix, 2001). Aspects of team management in project teams such as the anxiety to reach an agreement, power relations among team members, organizational assets related to culture models, the leadership style of the project manager and the complexity of the task should be considered when managing the conflict (Baron, 1988, Zartman, & Touva, 1985, Lawrence & Lorsch, 1986, Kozan, 1989, Pinto, 2018). The Table 1, shows the mains conflict management approaches.

The different studies where the approaches of conflict used by project directors and that have been represented by means of hierarchic constructions, have shown the cooperation and evasive approaches with a significant and positive effect in the efficiency of the project team (Ayoko, 2016; Chen, Hou, & Wu, 2016). Besides that, other studies have demonstrated that the accommodative or compliance style affects significantly and negatively the efficiency of the project team (Kuhn & Poole, 2000; Liu & Liu, 2009). However, these last findings are contradictory with those of Akhavan Tabassi, Bryde, Abdullah, & Argyropoulou, (2017). This study tries to verify these hypotheses in the context of international cooperation.

Conflict Management in International Cooperation Project Teams

Table 1. Conflict management approaches

Conflict Management Approach	Win/lose Perspective	Two dimensions Perspectiva
Cooperate-Integration	Win/ Win	High concern for others High concern for myself
Compete - Dominance	Win / Lose	Low concern for others High concern for myself
Adjust - Compliance	Lose / Win	High concern for others Low concern for myself
Avoid- Ignore	Lose / Lose	Low concern for others Low concern for myself
Involve - Cooperation	Partial Victory / Partial Victory	Average concern for others Average concern for myself

Source: Adapted from Rahim & Magner, (1995)

According to Lee and others, (2017) the type of project frequently determines the causes of the conflicts, that is why several approaches can be found to identify them. For example, for public projects the main causes in identified conflicts correspond to differences in information, confidence, interest, needs and valuations among the parts in conflict, as well as the shortage of resources, the existence of stakeholders such as ONGs, the social structure and the unilateral application of the project (Naderpajouh, Mahdavi, Hastak, & Aldrich, 2014; Awakul & Ogunlana, 2002). Those aspects can be classified in three categories: contextual factors, characteristic of the local project and impacts (Boudet, Jayasundera, & Davis, 2011). International Cooperation projects that have similar characteristics to those of the public projects, could also share these causes for conflicts.

Also in the public sector, there is another approach to classify the causes of the conflicts in projects; this approach considers the perspective of the involved main problem, showing three categories (Armour, 1991): 1) cognitive factors, related to differences between the perceptions and the systems of values in the stakeholders of the project; 2) environmental or economic factors, because the public interest prevails over the others and some stakeholders can be affected indirectly and; 3) the conflicts caused by the governmental authorities due to the spread of limited information that produces rejection from the different stakeholders of the project.

Finally, perhaps the more well-known classification of conflicts in the context of the team management is the one that includes/understands conflicts of tasks, processes and differences of interests (Chen & Chang, 2005; Behfar, Peterson, & Mannix, 2008), as followed: 1) conflict of tasks comes from the inconsistency in the definition and the execution of tasks which can take the proposed goal to an end, in this case the project; 2) the relation conflict includes emotional or personal problems among the team members, which can have a negative effect in the relation between the two parts (Liu, Shang, & Hu, 2010) and; 3) the process conflict is caused by differences and difficulties in the execution of the resources necessary to perform an activity such as the composition of the team project in a functional organization, the programming of the tasks or the allocation of roles and functions in the team (Jehn & Bendersky, 2003). In a similar way, Moore proposes a classification by the identification of five categories: data conflict, structural conflict, conflict of values and relationship conflict (Moore, 2014).

In this last classification about the causes of the conflicts, a significant relationship between the conflict of tasks and the conflict of relations has been demonstrated (Chen & Zhao, 2010) and unlike the other two types of relation conflicts, the one about relations must be avoided because it reduces ef-

efficiency of the project and the satisfaction of the stakeholders (Jung & Lee, 2015). Also, some studies have concluded that the conflict of tasks is more influential on the performance of the project and the conflict of processes which is the least frequent category, has a significant and negative influence in the performance of the budget of the project (Awwad, Barakat, & Menassa, 2016). These findings show the importance of the management of conflicts in the study of International Cooperation project management which is characterized by a high index of failures.

Thus, and considering that the conflict among the stakeholders hits the efficiency of the public projects (Jia, Yang, Wang, Hong, & You, 2011) and taking advantage that the *stakeholders* have been classified in internal and external in the project (Takim, 2009), the conflicts have been classified in the same way. In the construction area a significant incidence of the external conflicts in the delayed delivery and the cost overruns of the projects has been verified (Lee, y otros, 2017; Park & Jung, 2015). These external conflicts, sometimes have greater impact in the efficiency of the project compared to the internal conflicts and they are frequently related to social, economic and environmental aspects (Lee, y otros, 2017), which are strategic centers in the International Cooperation projects. Also, the internal conflict has been considered and its incidence in the efficiency of team projects has also been justified (Awwad, Barakat, & Menassa, 2016; Kerzner, 2009).

Talking about the resolution of conflicts inside a team, the studies of Yousefi and his colleagues when studying construction projects, propose methods such as negotiation and mediation (Yousefi, Hipel, & Hegazy, 2010), which are very convenient when using them and they depend a lot on the personal style of the director of the project as well as on the particular situation of the conflict (Lee K., 2008). Some researchers have associated these methods of resolution of conflict with the styles of handling conflicts (cooperative, committed, adjusted, competitive and evasive) proposed by Thomas & Kilmann (1974), who used their own tools in the organizational behavior area, to identify the style of conflict handling which each individual is more likely to use (Randeree & Faramawy, 2011; Shih & Susanto, 2010).

In the same way, Kerzner has recognized the relevance of the conflict in the discipline of project management, when he says that one of the fundamental abilities of a good project manager is the one to handle conflicts. In addition this author identifies as the main causes of conflict problems, the ones related to the human and physical resources, infrastructure, technology, culture and procedures of the organization, values and judgments of the team members, as well as the pressure to reach cost and time restrictions in the project, (Kerzner, 2009). This author also classifies conflict resolution styles in project management as a cooperative, committed, adapted, competitive and evasive, aligned to Thomas & Kilmann's proposal, (1974).

The objectives of this research are to identify the causes and styles of conflict management in International Cooperation team projects and analyze their impact in the efficiency of this particular kind of projects in the Colombian context. In this way, this research development is framed in the quantitative paradigm of non experimental research, because it uses the data collection and the statistical analysis to verify hypothesis, to establish patterns and to prove theories (Hernández, Fernández, & Baptista, 2010). That is why, for this study the variables derived from the proposed specific objectives were analyzed in search of an approach to the facts related to the context in which they appear.

This study is exploratory, descriptive and with a cross cutting perspective (Tamayo y Tamayo, 2003) because it includes the register and interpretation of the process of handling conflicts presented in International Cooperation team projects in Colombia. Taking this into account, a series of key variable that can describe such process have been defined (Hernández, Fernández, & Baptista, 2010). It means that, through the analysis of the variables, the researcher will be able to know clearly the way the investiga-

tion was oriented. Also, the research can be described as causal, considering that it tries to determine the influence of certain independent variables on the dependent ones, in this case the efficiency of the projects (Ouellet, 2001). In order to compare the results of this research with the ones obtained in other studies, the design of the methodology is similar to the studies with common characteristics in other areas such as the ones carried out by Lee, and others, (2017 and of Lu & Wang, (2017).

Once the revision of literature was done, a three-section questionnaire for data summary was designed. In the first section, demographic information related to the type of nongovernmental Organizations was inquired, as well as the project characteristics. The second section was devoted to collect data related to the implementation of methodologies to manage the conflict in each phase of the length of the project, these type of questions are designed based on the Likert scale. Finally, the third section is related to the instrument used for data collection, which contains questions related to the valuation of the internal and external efficiency of the project, it also was measured according to the Likert scale.

The population of this investigation is represented by the total of International Cooperation project managers in Colombia which is a large sample, considering that the parameter used was a proportion and that previous studies were not taken in to account on. Thus, it was required to use a random sampling that consisted of dividing the population in subgroups whose elements have common characteristics; that is to say, homogenous levels (Arias, 2006). The election of the size of the representative sample, was done according to the expression (Spiegel & Stephens, 2009):

In this case, as Spiegel & Stephens (2009), suggest to calculate the sample size under a maximum variability scenario, which means, $p=q=0.5$, with a 5% level of significance, 0,10 a maximum error of estimation (e), it results in a sample size (n) of 67 directors International Cooperation projects.

A pilot study with interviews was made, and its purpose was to perfect the language and the intention of the questions, improve the understanding of the included affirmations, and obtain preliminary results. Once the final version of the questionnaire is obtained and considering a non-answer rate, it was sent via e-mail to 107 project managers of which 72 questionnaires were properly completed. The tabulation and data analysis both as of descriptive type and independence hypothesis tests were made with the *statistical R® software*. The analysis of the data collected is shown in the following section, focusing mainly on the relationship among sources, types and mechanisms of conflict management, and on the influence of conflict management on the efficiency of International Cooperation projects.

The main objective of this chapter is to verify whether there is a significant relationship between the conflict management style within the project teams and the project performance. Based on the validation of the information collection instrument, project managers in Colombia were asked about the styles they use to manage the conflict in the project teams. With the application of a multivariate statistical model, the null hypothesis that there is no significant influence between conflict management styles and internal or external project performance was tested. The descriptive and inferential results of the analysis of the data collected are shown in the next section of the document.

SOLUTIONS AND RECOMMENDATIONS

In this section, the results of the analysis of the data collected from the research instruments of information compilation applied to International Cooperation project managers in Colombia are presented. The first part of this section is devoted to the descriptive analysis of the demographic characteristics of the sample; the second part is devoted to the analysis to solve the first question of the research related to

the characteristics of the process of conflict management in International Cooperation team projects. And the third part focuses on answering the second question of the research oriented to determine if the implementation of methodologies for the management of conflicts influences the efficiency of the projects. That is why the results of test hypothesis of the linear models among the variables of the study are presented.

Demographic Characteristics of the Sample

The sample is composed by 72 International Cooperation project managers associated to ONGs in Colombia, whose performance in the ONGs is classified based on the high-priority areas established by the International Cooperation strategy of the Cooperation Presidential Agency (APC in Spanish). Based on that, and about the composition of the sample, 36% of the participants work in ONGs and their projects go mainly to victims, reconciliation and human rights, 17% of the project managers taking part in the study belong to ONGs that take part in topics such as governance. With a similar proportion, (14%) project managers participated in areas like environment and risk prevention, as well as. opportunity equality and economic growth and competitiveness. All these projects together represent 15% of the total sample, as shown in figure 2 a.

Figure 2 b, shows the ONG's aging in the International Cooperation sector, as it is shown, 66% have been taking part in projects with international financing for more than 10 years, which is favorable for the objectives of this study. Figure 2 c, represents the frequency allocation for the team size variable of the project where it is observed that most of the cases (56%) the project managers, which are part of the sample, have led teams of more than 30 members. On the other hand, and after analyzing the data presented in figure 2 d, 89% of the project managers who took part of this research, had more than 5 years of experience in the International Cooperation sector. Finally, and about the origins of official and non-official investment funds for these projects, mainly (56%) come from the European Union, (38%) from the United States, and only 6% were financed in other places.

Research-First Question

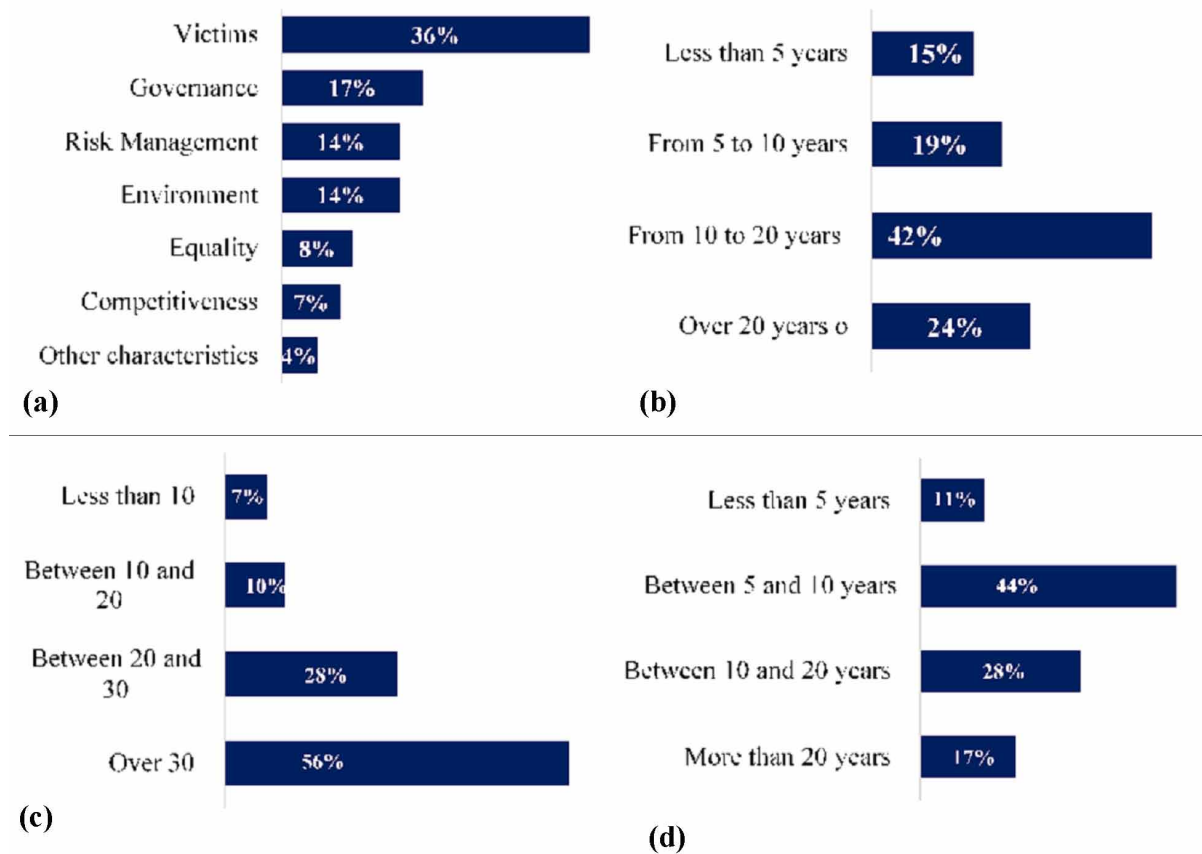
In order to answer the first question of the research, related to the identification of the characteristics of the conflict management in the International Cooperation context in Colombia, the theoretical references described in section 2 of this document were considered. These references, which are related to conflict styles and the different classifications of sources of conflict, gave rise to the design of the instrument in charge of collecting data. Then, a summary and the obtained results were discussed.

About the classification of the styles approach to face the conflict according to Thomas & Kilmann, (1974), described as cooperative, competitive, compliance, and evasive. The perception of the project manager shows that the most frequently styles used to handle conflicts arise with the stakeholders of the International Cooperation projects, and they are the collaborative and the cooperative which are directed to others and on self's concerns. These results are presented in Figure 3 and show that the conflict management styles where a winner and/or a loser is found, as the competitor and the compliance, are barely used by the International Cooperation project managers. When Analyzing the Variance (ANOVA in Spanish)) with 95% of confidence, and to contrast it with the null hypothesis of equality among these five styles, a significance level of 0.002 can be observed (*p value*). It shows that there is sufficient statistical evidence to reject this hypothesis. When verifying this result by means of the Bon-

Conflict Management in International Cooperation Project Teams

Figure 2. Demographic characteristics of the sample

Source: Own research



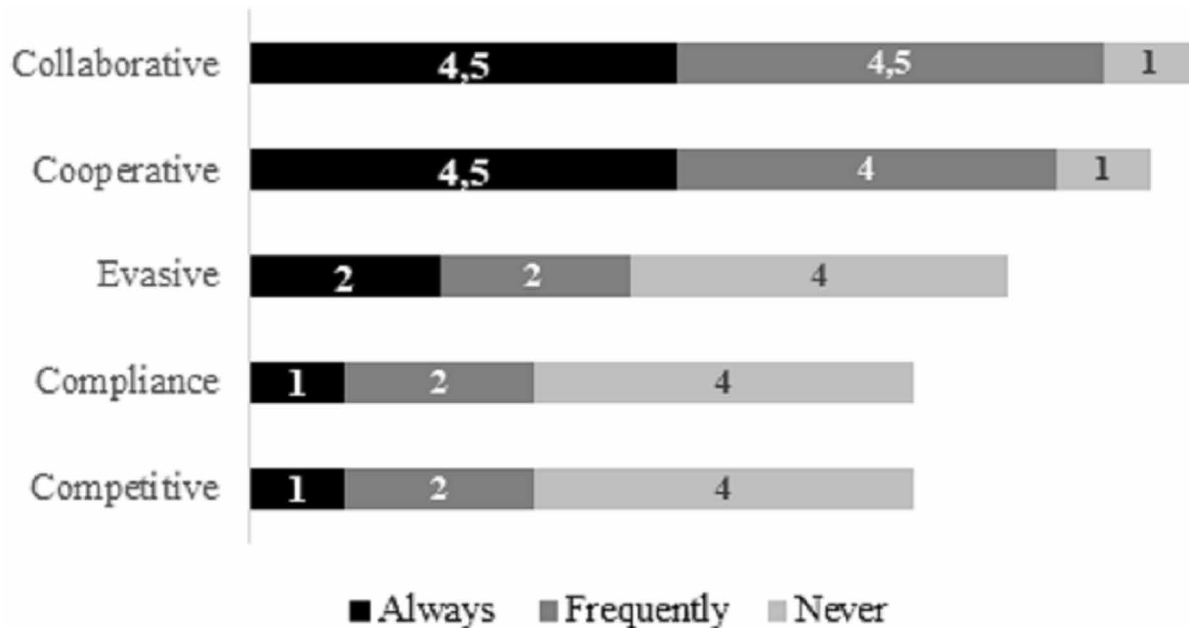
ferroni test, it is demonstrated that the measurement of collaborative and cooperative styles are higher than the competitive, compliance, and evasive styles.

In this research, the classifications of sources of conflict studied by Chen & Chang, (2005) identified conflict of tasks, processes and relationships. On the other hand, the study proposed by Armor, (1991) identified cognitive, environmental and communicative factors coming from the performing agent of the project. The results of the evaluation made by the International Cooperation project managers are shown in Figure 4 and Figure 5 respectively. The ANOVA tests carried out to contrast the hypothesis of equality average based on the causes of conflict in each of the classifications studied, presented p p values lower than 0.05, which show that there are significant differences in the evaluation of the causes and the Bonferroni test. It can be concluded that in the classification of Chen & Chang, (2005) the conflicts by relations and by processes are more important than the conflicts by tasks; on the other hand, in the classification of Armor, (1991) the conflicts by cognitive, economic and environmental factors are more important than the ones caused by poor communication coming from the NGO that implemented the International Cooperation project.

About the classification of the internal and external conflict, presented in projects of construction by Lee, and others (2017), it was asked the project managers their perception on their participation in

Figure 3. Conflict resolution styles used in international cooperation projects

Source: Authors' own research

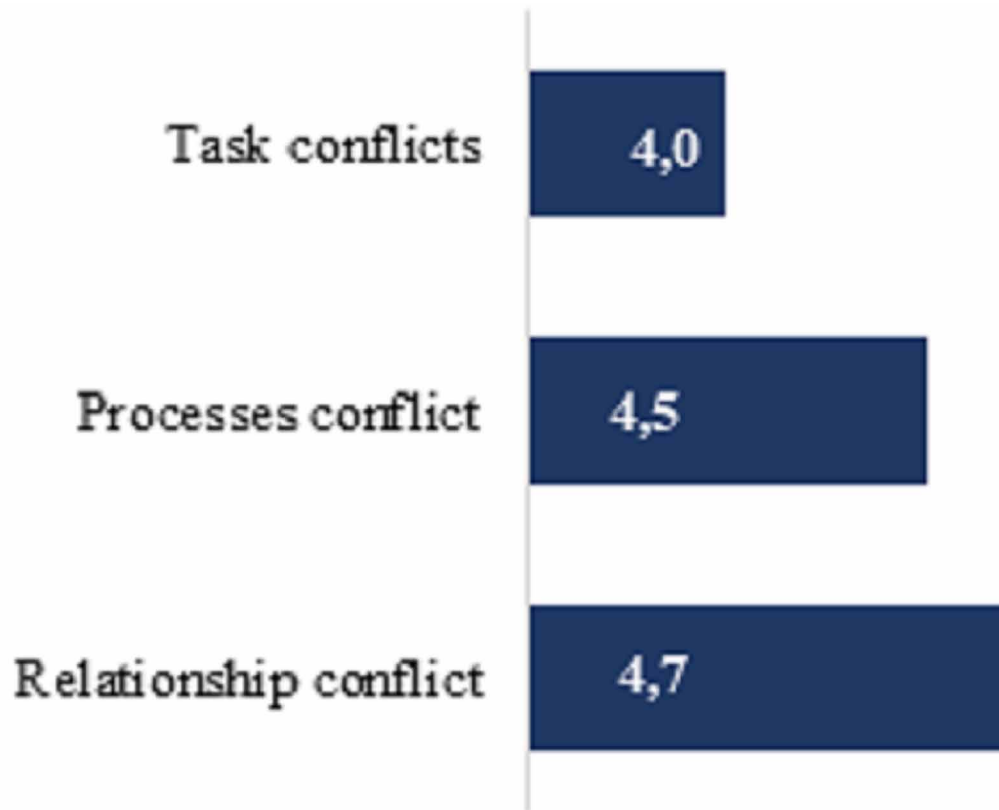


each one of the phases of the life cycle in the International Cooperation project defined by (Castro Silva, 2017). As shown in Figure 6, the conflict appears throughout all the cycle of International Cooperation the project. Nevertheless, it is evident that the internal conflict appears more frequently and with more intensity compared to the internal conflict, during the initial phase that identifies the intervention and in the final phases of transference of products to the beneficiary community and when evaluating the impact of the intervention. On the other hand, the opposite occurs when analyzing the internal conflict that appears more frequently and with more intensity that the external conflict, in the phases of beginning, planning, implementation and control of the International Cooperation project (see Figure 6). Taking into account that this classification about the conflict has to do with the classification of the stakeholders according to Takim, (2009) in Figure 6 it is also shown the internal and external *stakeholders* analyzed in the data collection instrument.

Research- Second Question

In order to establish the impact of conflict management in project management, chi-square statistics tests were carried out to compare the dependence among the characteristics of International Cooperation project management in Colombia identified in section 4.2 in this document, as well as the internal and external performance of the project. The internal performance has to do with time compliance, budget, scope and quality of the products; while the external performance deals with the satisfaction of the beneficiaries intervened, the participation of the beneficiary community, the sustainability of the project after being transferred, and the long-term impact of the project. Figure 7 shows the results

Figure 4. Conflict causes according to Chen & Chang, (2005)

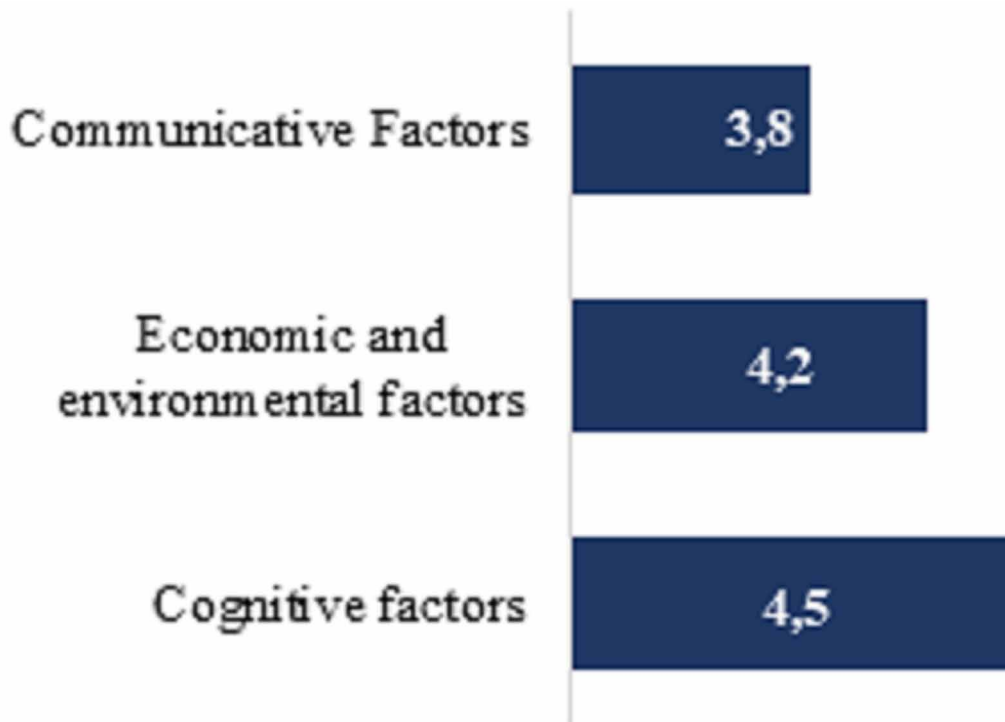


obtained from the perceptions of the project managers regarding the internal and external success of the International Cooperation projects.

In order to establish the impact of the five styles of conflict on the internal and external performance of the International Cooperation project, an optimal model of linear regression is generated and it explains the behavior of each one of the 8 factors of performance of the project (dependent variable) based on the 5 variables associated with the leadership styles (independent variable) implemented in the ONGs by the International Cooperation project managers. Table 2 shows the results of the analysis of variance used to test the null hypothesis $H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$, which proposes that the independent variables X_i are not adapted to explain the behavior of each one of the dependent variables associated with the factors of internal and external performance of the International Cooperation project. That is why it is deduced that coefficients β_i are zero. On the other hand, the alternating hypothesis of this *test* is that any of β_i has a value different from 0 which shows that at least one of X_i explains the behavior of each one of the dependent variables that in this case corresponds to each one of the eight factors of internal and external performance of the project. This null hypothesis establishes that there is no significant relationship between conflict management styles within the project team and project performance.

As shown in Table 2, and getting a 95% level of confidence as well as analyzing the *p estimates* obtained when applying Fisher's test F in each one of the eight models of multiple linear regression, it can be said that there is enough evidence to affirm that the independent variables explain the variability

Figure 5. Conflict causes according to Armour, (1991)



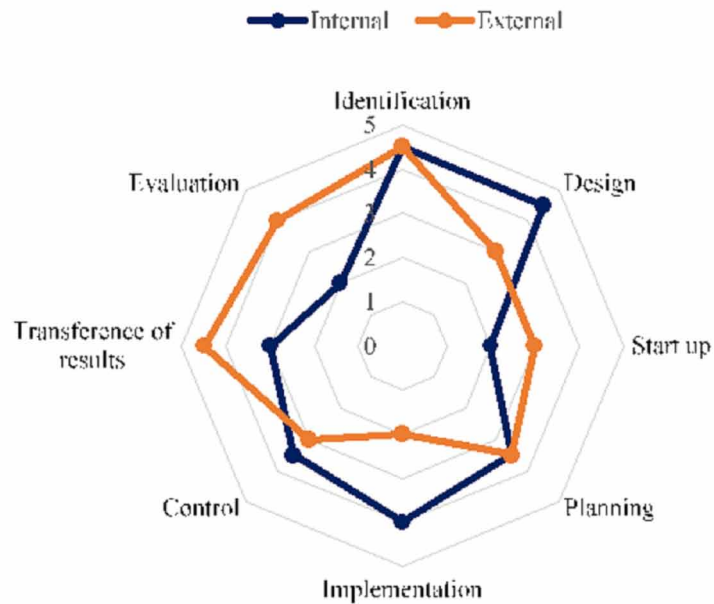
of the dependent variables related to the compliance of the timetable. In the same way, the variables related to the compliance of the budget that has to do with the internal performance of the project, and the dependent variables of satisfaction and participation of the community of beneficiaries of the International Cooperation intervention, regarding the external performance of the project. The explained variability of each one of the independent variables by the linear mixture of conflict management styles is shown in the column labeled R^2 in Table 2, for example, the model corresponding to the timetable compliance explains 73.7% of its variability.

In order to verify the compliance of the assumptions in the linear models that were significant to explain the behavior of the factors of performance of compliance of the timetable, the budget, the satisfaction of the beneficiary community and the participation of the beneficiary community, the following statistical tests were applied: for the assumption of homoscedasticity the test of White was applied. Then, to verify the non-correlation of errors, the test of Durbin-Watson was applied and finally, to verify the normality of errors the test of Shapiro-Wilks was applied. The results show the compliance of the assumptions of homoscedasticity, non-correlation and normal distribution of errors, for the four models presented in Table 2. Therefore, it can be said that the linear relations between the independent variables generated in each one of these four models explain the behavior of each one of the dependent variables or the ones of the performance of the project.

When analyzing the p estimates of the tests t and the standardized coefficients of regression of the linear models, it can be said that there is enough sample evidence to conclude that the collaboration and cooperation styles are positively related to the compliance of the timetable, the budget, the satisfaction of the beneficiary community and the participation of the beneficiary community. On the other hand,

Conflict Management in International Cooperation Project Teams

Figure 6. Perception of internal and external conflicts during the life cycle of the international cooperation project



Source of Internal Conflicts	Source of External Conflicts
Project Manager	Funder Agency
NGO's Leaders	State Entities
Team Members	Promoting Entity
Beneficiary Community	Beneficiary Community
Advisors and Technical Experts	Local Partners

Figure 7. International cooperation projects performance

Source: Author's own research.

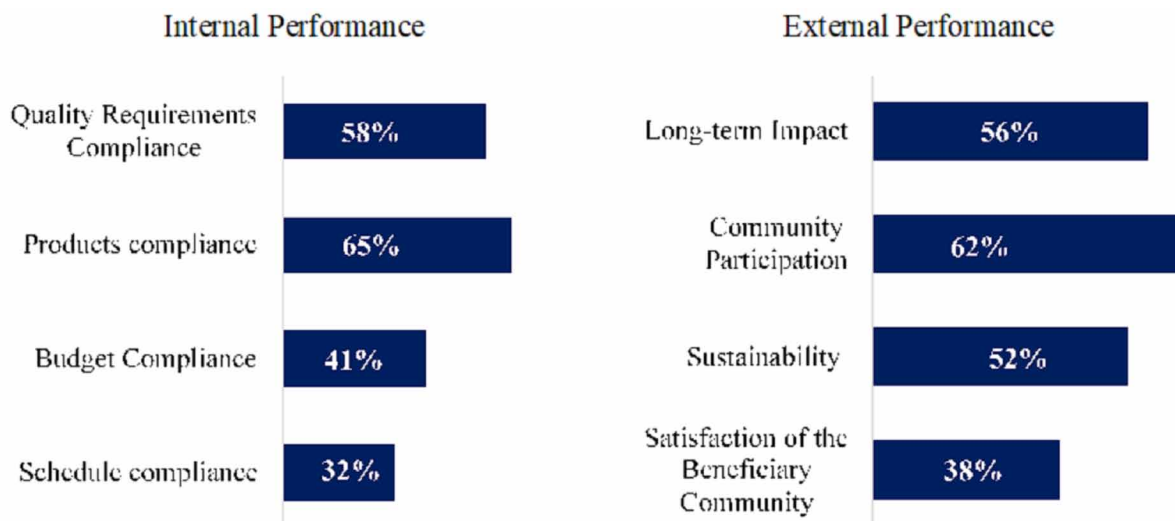


Table 2. Results of the analysis of variance for linear models

Dependent Variable (Critical Performance Factor)		R ²	P value
Internal Performance of the Project.	Timetable Compliance	0,737	0,010*
	Budget Compliance	0,684	0,006*
	Scope Compliance.	0,381	0,223
	Quality Requirements Compliance	0,309	0,667
External Performance of the Project.	Satisfaction of the Beneficiary Community	0,613	0,020*
	Participation of the Beneficiary community	0,771	0,011*
	Project Sustainability	0,552	0,628
	Long-term Impact.	0,411	0,452

* It corresponds to de linear models that are representative having 95% of confidence.

Source: Authors' own research.

the competitive style is negatively related to the performance variables. The results also show that the evasive and compliance models to handle the conflicts coming among the stakeholders of the International Cooperation projects are not significant to explain the behavior of the variables associated to the performance of the project.

The authors want to propose in an explicit way, the limitations of the results of this research, in order to suggest future researches to be cautious when analyzing and interpreting the results presented in this section of the document. The first limitation has to do with the characteristics of the cross-sectional type of study whose results reflect a particular period, so, these results can vary in the future. The second limitation is described by the results that reflect the opinions and perceptions of the managers of the participant projects in the sample, as well as the theory of probability and statistical inference, which made possible that the results vary when changing the members of the sample. Finally, the results show the perceptions of the project managers in Colombia, therefore, it is normal that when replicating the study in other geographical contexts these results may be different.

FUTURE RESEARCH DIRECTIONS

The authors identify like future lines of research, the study of handling of conflicts coming from other types of projects. Specifically, the team work of this research wants to do in the future any kind of work focused on the analysis of types of conflicts that arise in the engineering team projects, such as those from Information Technologies (IT), as well as projects in the construction and civil areas and projects in the field of electronic and electrical engineering. The preliminary hypotheses that arise for these future researches are related to verify the diversity of types of conflicts that come from the interior of team of projects which are conformed by members that have technical skills mainly. In that way, it would be possible to analyze if the selection of the resolution style and handling of these conflicts affect significantly the performance of the internal and external indexes of the project.

Also, the comparison of the types of conflicts, its causes and styles of resolution is identified like future line of investigation and handling of conflicts, differs significantly in project teams according to the characteristics derived from their conformation, such as the size of the project teams, type of scope

of the project, assigned budget, diversity of the stakeholders, and national and foreign participant members. To meet this goal, it will be necessary to select and implement appropriately multivariate statistical techniques according to the type of data and variables obtained in each one of the comparisons.

CONCLUSION

According to the perceptions of the project managers that took part in this study, it is possible to conclude that the conflict management in this particular and complex type of projects is characterized by the presence of the conflict during all the phases of the life cycle of the International Cooperation project. According to the classification presented by Takim, (2009) about the internal and external causes of the conflict, it was found that in the Colombian context, the external conflicts appear more frequently in the early stage of the identification of the intervention and in the end of the transference of products to the beneficiary community as well as on the evaluation stage. The internal conflicts are emphasized during the intermediate phases of the life cycle of the International Cooperation project, for example, in aspects such as design, planning, implementation and control.

About the classification presented by Chen & Chang (2005) related to the causes of conflict in tasks, processes and relations, it was found that the International Cooperation project managers in Colombia believe that the people related to the processes of the project and the relationship among the stakeholders, are the ones who have to manage most frequently. In this study the conflicts related to processes have to do with disadvantages in the achieving of human, technological or physical resources for the implementation of the intervention. whereas the conflicts on relationships come from differences in values, emotional or personal opinions, culture, language and problems among the stakeholders of the International Cooperation projects, that are diverse and complex compared with the traditional projects of construction or IT.

Keeping the same classification of characteristics for the conflict causes, this study deals with the classification presented by Armour, (1991) and concludes that the cognitive, economic and environmental factors are the ones that produce of a great amount of conflicts in the International Cooperation projects. The perception of the International Cooperation project managers is that the conflicts resulting in bad or incomplete communication of main aspects of the project from the NGO to the stakeholders, are the ones that must be managed less frequently.

In respect of the classification of the styles used to face the conflict presented by Thomas & Kilmann, (1974), the results of this research showed that the collaborative and cooperative styles are used meaningfully in the International Cooperation context in Colombia, whereas the competitive style is less used by the project managers. Generally speaking, the statistical evidence concluded that the styles of handling conflicts used to make the involved parties win or get satisfaction with the solution, are the most used ones in the scope of the project management.

Finally, and about the influence on the style for handling conflicts and the internal performance of the International Cooperation project, the results in this study conclude that there is a significant and positive relation between the cooperative and collaborative styles and the compliance of the time table and the budget. Also, it was possible to verify that the styles of conflict management affect positively and significantly the criteria essential for the external success of the CI, in aspects such as the satisfaction and the participation of the beneficiary community. The evasive and compliance styles were not significant to explain the behavior of the variables of performance of the CI. These results are coherent

with the studies presented by Lee, and others, (2017), Ayoko, (2016) Chen, Hou, & Wu, (2016) and Park & Jung, (2015) related to public and construction projects.

The contribution of this research, from the theoretical perspective of the project management has to do with presenting its characteristics in a context insufficiently studied and that needs big efforts by the academics so that high failure rates diminish, like the ones found in the International Cooperation project. From the project management perspective, this study recognizes the importance of the opportune identification of the sources of conflict and the selection and conscious implementation of styles for handling conflicts by the International Cooperation project managers and among the stakeholders, in order to get the internal and external success of their interventions.

The limitations presented in this study have to do with the fact that the results are based on the perceptions of the participants in the study, therefore, the data can be influenced by personal and environmental factors of each one of the 72 project managers. In this respect, verification by means of audit objective evidence, for example, to verify the internal or external performance of the project, was not taken into account in the methodology of this research. The cross-sectional character of the study means that it is possible that, when applying the same instrument for data collection in the future, the results can change. Finally, the context is exclusively delimited to implemented interventions of International Cooperation in the Colombian territory. These limitations should be considered in future studies, when looking for generalizations or transferring the findings to another kind of contexts in project management.

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KEY TERMS AND DEFINITIONS

Conflict: Any kind of controversy produced when having any activity related to the life cycle of the Project and that arises among the same team members or between team members and someone interested in the project.

Conflict Management: Mechanisms and strategies implemented by the project manager in order to deal with disputes or controversies that have arisen at any stage of the project's life cycle, either in the project team or with a member of the stakeholders.

External Performance of the Project: It refers to the indexes of compliance with the external factors of the project such as the satisfaction of the project stakeholders.

Internal Performance of the Project: It refers to the indexes of compliance with the internal success factors of the project, such as delivery of products according to the timetable, the budget and the quality of what is delivered in the project; as well as the compliance of requirements.

Project: In this chapter the project definition is the same as the one proposed by the Project Management Institute, and it is described as a temporary effort for the generation of a good, a service or a unique result.

Project Management: This chapter takes the definition of the *Project Management Institute*, which is the application of knowledge, skills, tools and techniques to project activities.

Chapter 16

Soft Skills as a Critical Success Factor in Project Management

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ABSTRACT

Project management is a field of knowledge that presented a notable development as a means of impact on organizational competitiveness. About 30 years ago, this field was considered as a series of tools that contributed in some aspects of improvement in organizations. Over time, these tools were transformed into theory and in the same way their development at the scientific level increased. Now, project management is recognized as the means through which the strategic plans in the companies are managed. Therefore, they form the bridge of business sustainability. Among the different developments that have been made in the project management is the establishment of critical success factors. The current literature offers various approaches. One of the research trends as a critical success factor that is proposed in the future is the identification and measurement of the soft skills of the project manager. This is how this chapter of the book will address the identification and analysis of soft skills.

INTRODUCTION

The changing and accelerated global economic trends are compromising business survival, since the economic opening patterns have affected the competitiveness patterns and indicators with which companies have traditionally managed the achievement of their goals, “The growing dynamism of the economies Emerging Asians, in the displacement of the world’s wealth, represents a challenge for the competitiveness of many manufacturing industries in the region” (CEPAL, 2014). That is, Latin America faces a serious threat from Asian expansion, since its Development models do not allow you to boost your productive

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infrastructure. This translates into a clear threat against corporate sustainability and the consequences derived from this type of affectation, such as job losses and economic slowdown.

In the last decade, project management as a field of knowledge has presented a notable development as a means of impact on organizational competitiveness. Approximately 30 years ago this field was considered as a series of tools that contributed in some aspects of improvement in organizations, over time these tools became a specific field of knowledge, and subsequently there has been the emergence of a theory of projects, and as a result of this expansion, the knowledge of project management at the scientific level increased. Today the discipline of project management is recognized as the means through which strategic plans in companies are managed, therefore, they are configured as the bridge towards corporate sustainability. Among the developments that project management has had, is the establishment of critical success factors. Various scientific investigations have been carried out in order to establish the impact that soft skills have on project management and performance (Naoum, Fong, & Walker, 2004; Hussain, Ahmed, & Zulqarnain, 2015; Shi & Chen, 2006). These investigations have shown that there is a positive and significant relationship between soft skills and project performance. In the literature there are different approaches for the identification of factors, on which the success of a project depends, some of them are related to time, cost, objectives and interested parties, among others. One of these research trends in the field of critical success factors in project management is the identification and measurement of the soft skills of the project manager. Research conducted by (Bailey, 2014; Grieve, 2013; Gillard S., 2009; Moss & Tilly, 1996) established that different types of employers identified gaps in their workers consisting of the lack of essential soft skills, this same void It was established by (Allington & Fernández-Fuentes, 2013) when identifying that there is a difference between the training of students in universities and the requirements that at the level of soft skills employers require. The usefulness of this chapter focuses on determining the importance of soft skills as a critical success factor in project performance, and therefore, it is expected to make a contribution so that traditional paradigms that focus on hard skills or knowledge such as Critical success factors in projects, therefore, focusing on interpersonal skills as a criterion of success in projects transforms the traditional paradigm. Thus, this chapter will address the identification and analysis of soft skills, and their relationship with the performance of projects from a research gathering point of view, so that a cutting-edge research can be presented in this regard.

The methodology established for the development of this chapter was based on reviewing scientific databases such as emerald, sciencedirect, scopus, dialnet and ebscohost, in the same way books of the themes analyzed were reviewed. The topics that were searched were soft skills, project management, and project performance. Based on the information collected, the literature was reviewed in the following division of project management and background issues, characterization of soft skills, and soft skills as a critical success factor in projects.

PROJECT MANAGEMENT: CONCEPTS, METHODOLOGIES AND CRITICAL SUCCESS FACTORS

One of the most accepted definitions of what a project is, is recorded in the British Standard, which states the following: a single process consisting of a series of controlled and coordinated activities, undertaken to achieve a goal according to some specific requirements, including time, cost and resource limitations (British Standard, 2000). That is, starting from the previous definition, and having established

in the introduction, that the project is the operational unit of development through which the strategic objectives materialize, a series of own characteristics can be determined, such as the project must have a certain start and end time, in addition to this time constraint, two others are presented depending on the costs and scope that must be obtained, that is, there is an objective that must be achieved through one or several deliverables.

Some developments in the field of projects worldwide, have established that for a project to be considered successful, it must meet three restrictions or conditions, these are time, cost and scope. These restrictions presented in Figure 1, become parameters or referents that must be met, in order to meet certain expectations of stakeholders or people who influence the development of projects. When talking about time in projects, reference is made to the duration of the same in terms of the critical route, since this duration must be understood in the same way in dates set as calendar days or working days, this in response to the haste or execution requirements themselves; Likewise, it should be clarified that the use of techniques such as resource leveling and PERT / COST, will be useful to estimate the best time alternative in a project, and subsequently the monitoring and control strategies must guarantee compliance with the established times, and in case of significant variations, be able to take the necessary corrective measures, leaving a record of them under the parameters, procedures, or formats established for that purpose.

The second restriction refers to the costs, that is, the different outflows of money or expenditures established in the formulation phase. These cash outflows must be described, analyzed and refined in the budget and cash flow structures, indicating the items that make up the investment, the costs and expenses distributed over time; and because it is a sensitive item it must also be subject to control and monitoring.

Finally, and as the third restriction is the scope, this refers to ensuring that the project only includes the work required to meet the objectives set, this is usually recorded in the project start-up record, and responds to the fact that normally Interested parties tend to request aspects different from those initially involved, without taking into account cost overruns and delays over time.

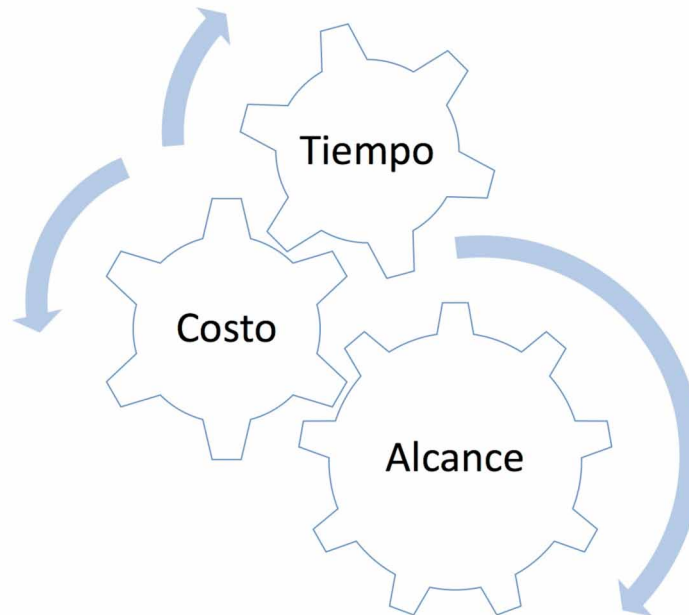
The performance of a project manager will be measured by their results, that is, by meeting the goals defined for the project. A project manager must possess a set of skills and competencies, very well determined, such as leadership, ability to anticipate events that may affect the project, negotiation skills, teamwork, motivation of staff, planning and work under pressure. Figure 1 illustrates the three constraints, which have traditionally been taken into account when estimating the success of a project, and under which many project managers focus, in order to generate results, which means that, from the fulfillment of the parameters cited in Figure 5, it would be inferred that the project has been successful. However, and as will be seen later, the efficient, adequate and successful fulfillment of a project is based not only on the analysis of these three restrictions, but also on the understanding and management of other interconnected variables, which may have a high level of impact on the project, this type of analysis is reached, when establishing the management of projects in complex environments.

Likewise, it is important to clarify that, for some organizations, both time and cost may vary, but as long as the project's objectives are met, it is considered successful; This goes against the traditional assumption that the three restrictions must be met in order for the project to be considered successful.

On the other hand, the skills required by a project manager are translated into different types of competences, within them, as mentioned above, the one related to knowledge, which is based on understanding and carrying out a critical process, on the areas of development of any methodology. Additionally, according to (PMI, 2007) there are performance competencies, defined for project managers that are considered as natural or acquired skills, that intervene in the activities of project management, which

Figure 1. Triple restriction in projects

Source: Prepared by the author



increase the probability of delivering projects that meet the requirements of the interested parties; they are developed in five units, which follow the process of project management, framed in the cycle of continuous improvement, complemented by very well defined elements, which are presented in Figure 2.

The competences presented in Figure 2 are exclusively of a technical nature, that is, those necessary to manage the knowledge areas of the project, under the parameters normally established by the PMI methodology. However, these competencies must be complemented by elements or factors specific to the project team or the project manager. This type of competence is known as personal competences, which basically are behaviors, attitudes, and characteristics of the personality, which contribute to the administration of projects (PMI, 2007). The purpose of the analysis of this type of competences is based on the fact that the project manager must have skills to be able to relate to other people, understood as a project team, suppliers, clients, and interested parties, in order that any type of requirement, conflict, needs or management can be carried out in a timely manner, generating positive impacts on the project. See Table 1.

According to (Charvat, 2003) there are seven methodologies in projects that are briefly described in Table 2.

Another aspect that is relevant to take into account is the importance of project management, not only in the first phases of project planning, but throughout the life cycle of the project, in such a way that compliance with the objectives is guaranteed defined for the project, see Figure 3. For the above, taking as reference some of the most used methodologies, worldwide, such as the PMBOK of the Project Management Institute, PMI®, the agile software development methodology, SCRUM® and the structured method of project management PRINCE2®, PROjects IN Controlled Environment, proposes a comprehensive vision of the participation of the project manager throughout the entire project cycle:

Figure 2. Triple restriction in projects

Source: Prepared by the author

COMPETITION UNIT	ELEMENT ASSOCIATED WITH COMPETITION
Phase 1: Initiation	1. Project aligned with the organizational objectives and customer needs. 2. The preliminary scope statement reflects the needs and expectations of the interested parties. 3. High levels of risk, assumptions and restrictions are understood. 4. Stakeholders are identified and their needs are understood. 5. Approved project.
Phase 2: Planning	1. The scope of the project is agreed. 2. The project schedule is approved. 3. The budget is approved. 4. The project team is identified with agreed roles and responsibilities. 5. Communication activities are agreed upon. 6. Processes for quality management are established. 7. The risk response plan is approved. 8. Integrated change control processes are defined. 9. Approved purchasing plan.
Phase 3: Execution	1. The scope of the project is achieved. 2. The expectations of the interested parties are managed. 3. Human resource administered. 4. Quality management versus planned. 5. Material resources administered.
Phase 3: Monitoring and Control	1. Tracked project and its status is communicated to the Stakeholders. 2. Changes in the project are managed. 3. Quality is monitored and controlled. 4. Risks are monitored and controlled. 5. The project team is managed. 6. Contracts administered.
Phase 4: Closing	1. The results of the project are accepted. 2. Project resources are released. 3. The perceptions of the Stakeholders are measured and analyzed. 4. formally closed project.

Soft Skills as a Critical Success Factor in Project Management

Table 1. Personal competencies for project management

Communication	Leadership	Management	Cognitive ability	Effectiveness	Professionalism
Effective exchange of accurate, appropriate and relevant information with Stakeholders through appropriate methods	Guide, inspire and motivate project team members and Stakeholders	Effectively manage the project through the proper use of human, financial, material, intellectual and intangible resources	The project manager must apply the perception, the discernment, the judgment to effectively direct the project team	The project manager must produce the expected results through the appropriate use of tools, resources and techniques in all activities.	They conform ethical behaviors, including aspects such as responsibility, respect, fairness and honesty in the practice of project management

Taken and adapted from (PMI, 2007).

The selection of the methodology to be used for the management of a particular project depends on several factors, such as the type and complexity of the project. Taking into account the above, the selected methodology must be applicable and scalable during all phases of the project. Additionally, the selected methodology must have the flexibility to be applied integrally in each of the phases of the project. For example, the phase of formulation of a project, is in turn a complete project, with work packages, time estimation, definition of activities and resources.

SOFT SKILLS: DEFINITION AND CHARACTERISTICS

The definitions suggested by some researchers are varied with respect to soft skills. According to (Weber, Finely, Crawford, & Rivera, 2009) soft skills are described as interpersonal, human, or behavioral skills, necessary to apply technical skills and knowledge in the workplace. Similarly, (Holt, 2018) states, that soft skills can be defined as personal qualities, which allow an employee to interact effectively and in harmony with other people, co-workers and clients in the workplace. (Moss & Tilly, 1996) define soft skills, such as those abilities and traits that belong to personality, attitude and behavior, instead of formal or technical knowledge. Similarly, (Sutton, 2002) pointed out that social skills are so important, that employers identify them as the number one differentiator for job applications, in all types of industries.

In this same sense, (Perreault, 2004) defines the soft skills as personal qualities, attributes and the level of commitment that distinguishes a person, from others, who can have a similar education and experience; additionally and in accordance with what is established by (James & James, 2004), soft skills are a new way of describing, a set of skills or talents that a person can bring to the workplace, including career attributes, such as work in team, communication, leadership, customer service and problem solving skills. Because social skills are fundamental to productive performance in the workplace, current and future business leaders are emphasizing the development of social skills (Nealy, 2005). Studies have established that 75% of long-term job success depends on the soft skills of people, while only 25% depends on technical knowledge (Klaus, 2010). On the other hand, hard skills contribute only 15% of a person's success, while 85% of success is due to soft skills (John, 2009).

Table 2. Description of methodologies in projects

METHODOLOGY	CHARACTERIZATION
WATERFALL	Originated in 1970. The waterfall model is a diagram representation depicting the main phases of software development. The methodology is currently one of the most widely used. Phases: a. Requirements analysis. b. Design. c. Code & unit testing. d. Subsystem testing. e. System testing.
PRINCE2® (Projects in Controlled Environments)	This methodology is now so popular that many companies hire only PRINCE2-certifies project independent of any particular project type and complexity. Features: a. A defined project management structure. b. Flexible decision-making points. c. A system of plans for resources and technical issues. d. A set of control procedures. e. A focus on products-deliverables to the client. f. A focus on project deliverables throughout the project.
PMI® (Project Management Institute)	This methodology is currently the highest degree of acceptance in the Americas. This North American methodology is based on the description of several processes: Start, Planning, Execution, Monitoring and Control, and Closure. Within these processes PMI offers 9 fields that guarantee the success of a project: integration, scope, time, costs, quality, human resources, communications, risks, acquisitions, and stakeholder management.
IPMA® (International Project Management Association)	This methodology has a strong influence at European level. This methodology offers a broader perspective of the project environment. This is based on the analysis of three integrated dimensions: Perspective, People, Practice. This leads to a deeper understanding and management of soft skills, since it touches them in a broad way.
NEW PRODUCT DEVELOPMENT	This Methodology is essential for the creation of products that satisfy needs of industrial customers and differentiate company among competition. The NPD process has specific character in case of industrial sector, taking into account the level of product personalization and possibilities of close cooperation with final client. The specific phases of this methodology are: a. Idea. b. Research. c. Develop. d. Testing. e. Analysis. f. Intro
SYSTEM DEVELOPMENT LIFE CYCLE	Is in essence a waterfall methodology. It is a process of creation or modification of the systems, models and methodologies that people use to develop these software systems. The phases of this methodology are: a. Discovery. b. Design. c. Construction. d. Implementation. e. Follow-up.
RATIONAL UNIFIED PROCESS	It is a customizable project methodology framework aimed primarily at software development. It is a complete software development process framework that comes with several out of the box examples. The phases of this methodology are: a. Inception. b. Elaboration. c. Construction. d. Transition. These phases are accompanied by the following workflows: a. Business modeling. b. Requirements. c. Analysis & Design. d. Implementation test. e. Deployment. f. Configuration.

Source: Charvat, 2003

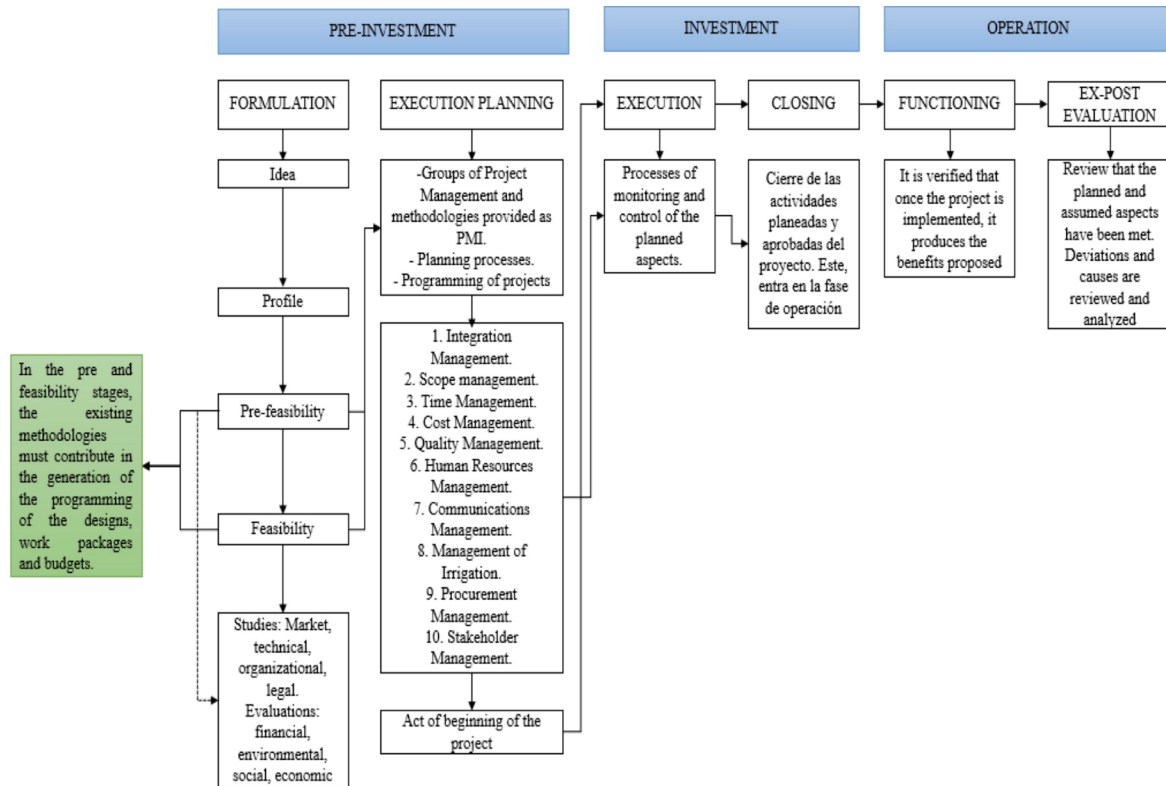
One of the factors that determines how important soft-skills research is, can be seen in technological growth, the expansion of a global communications and IT infrastructure, the aging of the workforce and the growth of the knowledge economy, have driven the demand for workers with new skills.

Employers from different sectors have identified a gap in their employees, which is based on poor skills for: problem solving, teamwork, communication, time management and cultural adaptability (Bailey, 2014) (Grieve, 2013; Gillard, 2009; Moss & Tilly, 1996).

Recent research shows a gap, perceived between the skills possessed by many university graduates and the requirements of employers in the fastest growing sectors (Allington & Fernández-Fuentes, 2013). In 2013, at a conference held in Canada, it was established that of 1538 employers in Ontario, more than

Figure 3. Project life cycle

Source. Prepared by the author



70 percent of the respondents, perceived that there is a gap in the “essential skills” among their current employees and, consequently, that “there is clearly a need to improve essential skills in the workforce” (Conference Board of Canada, 2013).

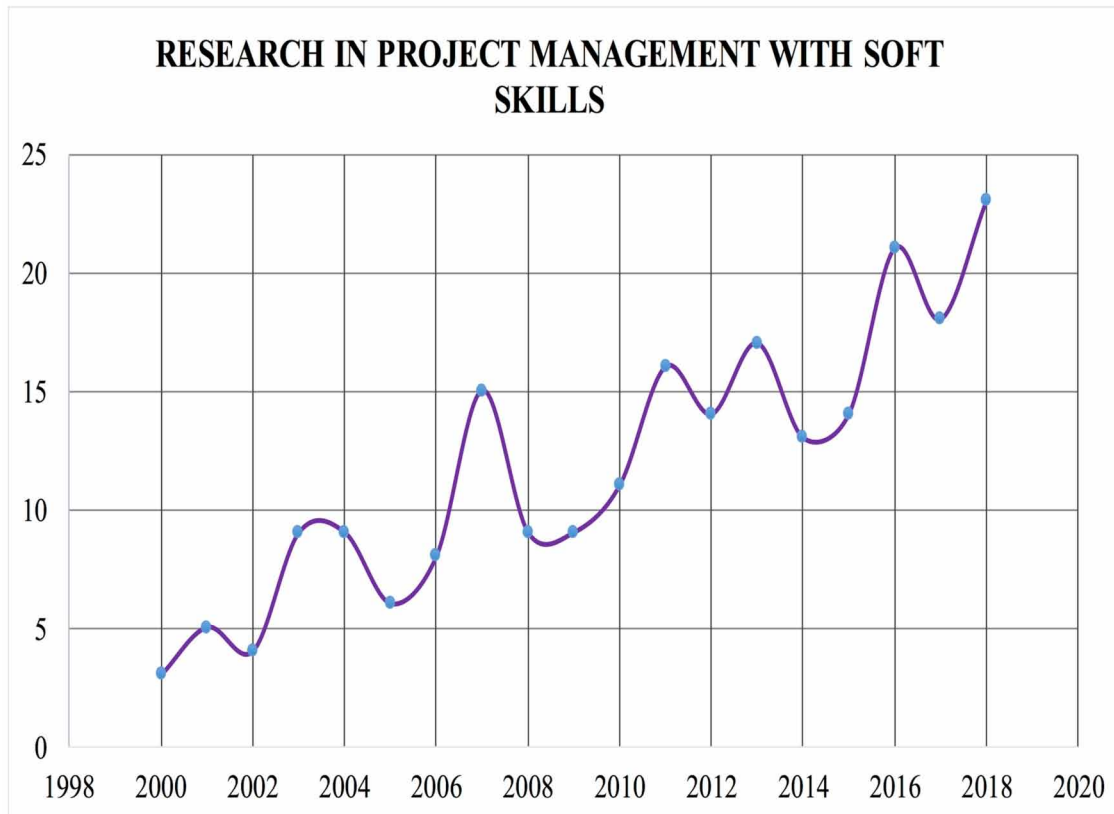
Research in the field of soft skills, and its relationship with Project Management, have shown a clear trend of growth. According to the Scopus database, this tendency is evidenced, every time, that since the year 2000 can be seen a constant growth in research production in these fields of knowledge, Figure 4 shows this trend. Subsequently, the investigative interest currently presented in the field of soft skills will be explained as a critical success factor within the projects.

In the same way, it is important to point out that in the characterization of this growing investigative tendency, it is also important to investigate which are the areas of knowledge, in which these investigations are being carried out, figure 5 presents information in this regard. In addition, it is important to mention that in this figure the fields of knowledge that contain 90% of the total of investigations are condensed.

Traditionally, critical indicators of success have been established in projects from a hard skills perspective, that is, purely technical aspects, however, some investigations have been able to determine that soft skills make up a group of variables Successful criticisms within projects, according to (Naoum, Fong, & Walker, 2004), soft skills are a critical variable for the project manager. A related research, carried out by (Hussain, Ahmed, & Zulfarnain, 2015), established that there is a positive, and statistically

Figure 4. Research in the fields of project management and soft skills

Source: Prepared by the author



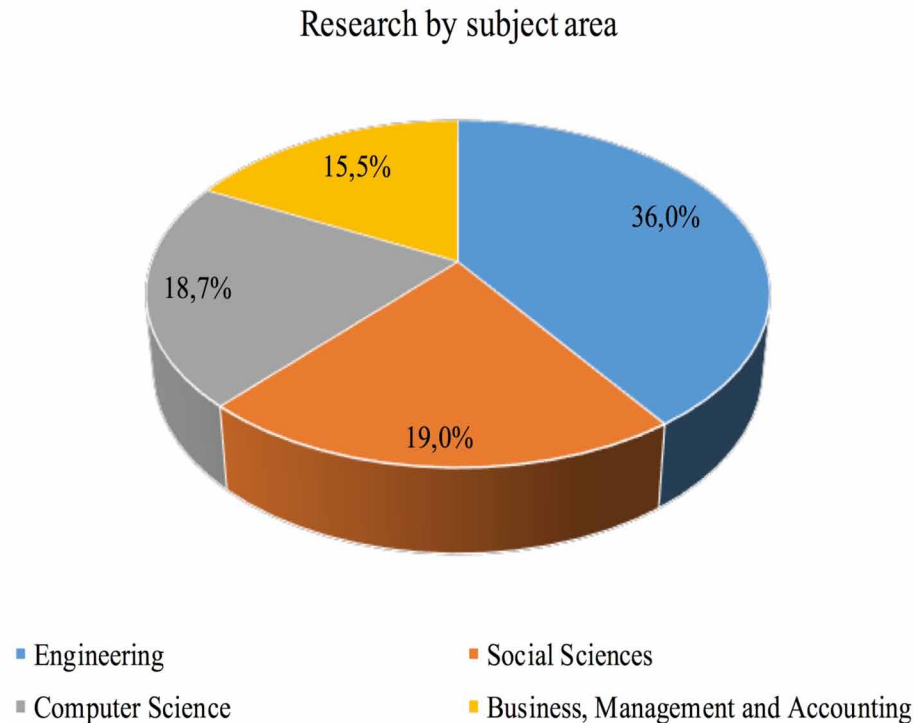
significant, relationship between each of the soft leadership skills identified, the success of the project, and the impact of the moderation of teamwork, on soft leadership skills.

Since the beginning of the 21st century, researchers like Kirsch have supported, not only the use and development of hard skills as a critical success factor, but also the inclusion of soft skills, as a key aspect in project management. This same acceptance was made by (Shi & Chen, 2006), who recognized soft skills as a fundamental aspect in any project.

The soft skills, described by (Belzer, 2004) as an art form a management process and work with people, which guarantees customer satisfaction with the purpose of retaining them, thus forming a favorable environment, so that the project team can deliver high quality products, timely and within budget, that meets the expectations of interested parties. The results traditionally expected in a project have time, cost and quality performance criteria (PMI, 2013; Archibald, 2008; Menches & Hanna, 2006). Nowadays, organizations carry out more structured projects in different fields producing several effects; these effects and changes involve a variety of dimensions and a several variables, qualitative and quantitative, that make their evaluation and management a complex, even though strategic, subject (Linzalone & Schuima, 2015). According to Zuo, Zhao, Gao, & Nguyen (2018) soft skills of project managers significantly contributed to project success factors and hence the project success.

Figure 5. Soft skills research by areas of knowledge

Source: Prepared by the author



The skills required for success in the workplace have changed dramatically in recent years, today, to survive in the competitive and dynamic business world, employees must possess both hard and soft skills (Ibrahim, Boerhannoeddin, & Kayode, 2017; Kumar & Hsiao, 2007). Most employers expect workers to demonstrate and excel in many soft skills, such as teamwork and group development (Rothwell & Arnold, 2007). Employers expect their employees to demonstrate a combination of skills, including interpersonal skills, project management techniques, cognitive skills and leadership behaviors, supported by project management education (Brown & Bowen, 2009).

On the other hand, during the development of a project there is usually a natural tendency towards the generation of conflicts, which are generally associated with the interaction of people, budget, programming, power and political management, necessary when a project crosses the functional limits and increases its complexity. (Peled, 2000) suggests that the function of the project manager is broader, than the single management of the project processes, therefore, it must be taken into account that the successful management of a project involves soft skills, which include interpersonal capacity, technical competencies and cognitive ability, together with the ability to understand the environment and people, and then dynamically integrate the appropriate leadership behaviors (Baroudi & Pant, 2008). Soft skills are non-tangible skills, which can include emotional intelligence, communication, problem solving and managing conflict situations (Marando, 2012).

As research in the field of projects continues to advance, it is clear that the success of the project manager, not only depends on their proper development with technical skills (Gillard S., 2009). There

is scientific evidence that engineers are expected to possess soft skills as project managers, in addition to specific technical skills (Pulko & Parikh, 2003).

According to Schulz (2008), for decades both educators and employers have complained about the lack of soft skills among their graduates and collaborators; in this same sense they pronounced themselves (Heckman & Kautz, 2012), when affirming, that the tests of performance realized in educational institutions, do not properly capture the social skills, so valued in the labor market as in institutions of higher education. An important issue that has not been studied so far, refers to the reasons why it is important for a professional, involved in the field of project management, to acquire and develop several soft skills. According to (Schulz, 2008), an explanation for this need is based on the demand of professionals with well-defined competitive advantages. This is how employers prefer to receive productive professionals who are young, which implies the management of concepts, contexts and applications of their profession, and it is in this last point, in which soft skills play a fundamental role for the acceptance of the professional in an organization, and for its future development at a social-corporate level.

“Project managers who operate within a matrix organizational structure and who advocate large-scale initiatives are in a paradigm of communication unparalleled in any other management position. Excellent interpersonal skills, or soft skills, are necessary requirements for success” (Gillard S., 2009).

According to (Adams, 2016) there is a list of soft skills, which are complemented according to the type of hard skill defined for a project manager, this complementarity of skills are illustrated below:

It is possible to think of a way in which the hard skills (techniques) of the project manager (figure 6), are supported by soft skills that empower them and that additionally allow this manager to manage in a more efficient way the Stakeholders involved, since it is important to mention that different projects, in their different stages, depend exclusively on the authorizations that the Stakeholders are providing, according to different aspects, therefore, an appropriate management of these, can guarantee the fulfillment of requirements planned at the beginning of each project, and this, consequently, configures soft skills as a critical success factor. Other soft skills included by (Schulz, 2008) are: critical thinking, creativity, cultural awareness, and time management.

It is important to establish that affinity has soft skills, with the standards and methodologies accepted worldwide in project management, such as, for example, the Project Management Institute, or the Deming cycle of continuous improvement. These project management processes are: initiation, planning, execution, monitoring, control and closure (Project Management Institute, 2017). Based on these aspects, (Marando, 2012) established an alignment between soft skills with these groups of processes as follows:

It is important to mention that Table 3 does not delve into the inclusion and analysis of the technical skills necessary in each of the processes. From this Table can be established, how soft skills associated with communication, analysis and problem solving, negotiation, and conflict resolution underlie and complement the necessary hard skills and disseminated by the PMBOK. As established (Gillard, 2009), the skills required for project management are divided equally into technical or “hard” skills, such as risk management and programming, and “soft” people-oriented skills, such as interpersonal communication. On the other hand, according to (Van Ingen, 2007), the effective management of a project is a balance of organizational skills, and people’s abilities, while (Brousseau, 1987), proposed that the communication and leadership skills of a project manager, they are more important than technical skills.

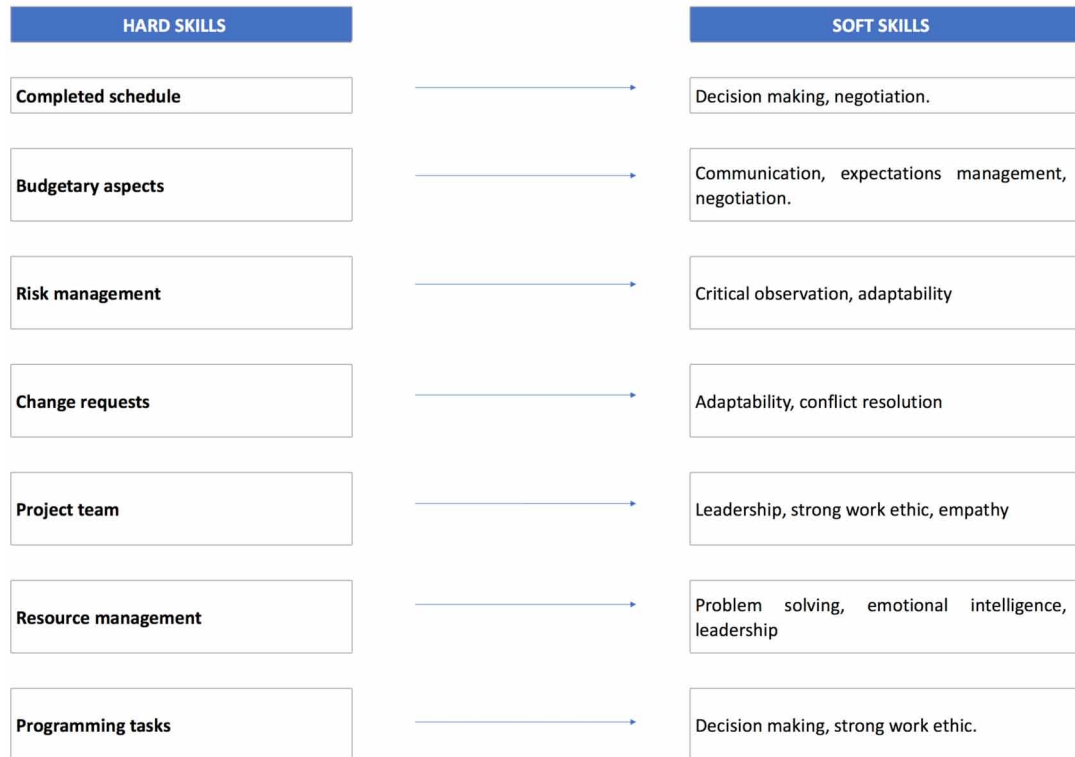
In this way, the Project Management Institute has characterized, the importance of soft skills for the project manager is as follows:

“Soft skills” are behavioral competencies that include communication skills, emotional intelligence, conflict resolution, negotiation, influence, team building, and group facilitation. These soft skills are

Soft Skills as a Critical Success Factor in Project Management

Figure 6. Correspondence between hard and soft skills

Source: Prepared by the author



valuable assets, when the project team is developed. For example, the project management team can use emotional intelligence to reduce tension and increase cooperation, identifying the evaluation and control of the feelings of the project team members, anticipating their actions, acknowledging their concerns and making a difference. Track your problems.”

Table 3. Soft skills associated with project management processes

PROJECT PROCESS GROUPS	ASSOCIATED SOFT SKILLS
Start	Describe ideas and opportunities for those who influence and authorize projects. Dialogue necessary to reach consensus on different aspects of the project.
Planning	Determination of objectives and measurable results of the project. Establishment of the organization of the project team and necessary procedures.
Execution	Filtering the information at the appropriate level of detail for the audience. Identify, evaluate, prioritize and communicate risks and problems.
Monitoring and Control	Report on the work carried out and in progress.
Closing	Evaluate and communicate success criteria. Persuade the team and management to prioritize the lessons learned.

Source: Charvat, 2003

From the previous characterization, it can be rescued that for the PMI the soft skills are a valuable asset, that is, they include the concept in the traditionally known as, valuation of intangibles, which in turn is part of the field of knowledge management; In this way, the PMI considers soft skills as a critical success factor in project management. In this same direction he has referred (Hermarij, 2016), who argues that in methodologies similar to PMI® such as IPMA®, and PRINCE2® it is necessary to include soft skills, that is, skills aimed at people, such as leadership, communication, negotiation, conflict resolution, and results orientation. Additionally, the literature mentions that soft skills do not only apply to projects but extend them to the management of programs and project portfolios. In this way, soft skills directly and indirectly support the achievement of the strategic plan of the organization, and, therefore, contribute to the survival and sustainability of the organization.

According to the sources consulted, each one of the variables mentioned is defined below:

- **Motivation:** The motivation is to provide a reason for someone to act. Team motivation is achieved by empowering them to participate in decision making and encouraging them to work independently (PMI, 2017).
- **Manage stress and conflict:** Conflicts are inevitable in the environment of a project. Sources of conflict include resource shortages, programming priorities and personal work styles (PMI, 2017).
- **Cognitive skills:** relates to work-related behaviors and outcomes, and especially job performance.
- **Communication:** The communications describe the possible means by which the information can be sent or received, either through communication activities, such as meetings and presentations, or objects, such as emails, social media, project reports or project documentation (PMI, 2013).
- **Teamwork:** Ability to function effectively as an individual and in a group with the capacity to be a leader or manager as well as an effective team member (Zaharim, *et al.*, 2010).
- **Leadership:** The knowledge, skills and behaviors necessary to guide, motivate and lead a team, to help an organization achieve its business goals (PMI, 2013).

Various authors, as Hussain, M. Ahmed, K. Zulqarnain, W. (2015), PMI (2013), Zaharim, A. Ahmad, I. Yusoff, Y. Omar, M. Basri, H. (2012), Musa, F. Mufti, N. Latiff, R. Amin, M. (2012), D.C. Smith, M. Bruyns, S. Evans, (2011), IPMA®, and PRINCE2®, among others in their research carried out in the last five years, have established a group of soft skills that affect project performance, the variables that make up this group of soft skills are shown below:

In a structural model (confirmatory factor model) is possible to establish as a latent variable the soft skills that have been most frequently established from the literature review carried out, and as observable variables to motivation, manage stress and conflict, cognitive skills, communication, teamwork, and leadership. However, this last variable must be addressed more specifically in order to determine the most appropriate type of leadership.

CONCLUSION AND FUTURE RESEARCH

In the investigations analyzed in this chapter it has been shown that there is a positive and significant relationship between soft skills and project performance, soft skills are basically personal qualities or talents that a person can and should contribute in their workplaces. Similarly, the future success of a professional is related to the appropriation and use of soft skills.

Soft Skills as a Critical Success Factor in Project Management

In a complementary way, it could be evidenced that employers in different sectors established gaps in their employees in the application of soft skills, this is shown with a weakness that must be improved in order to close the gap described.

Research conducted to establish the relationship between soft skills and project management shows a growing research trend. As a result of this research, it has been established that soft skills have become a critical success factor in projects, therefore, those professionals who work or want to work in the field of projects must have a successful management of soft skills, so that they can perform adequately as project managers in search of meeting their requirements.

A fundamental contribution in this chapter was to establish that the traditional iron triangle on which the success of a project was considered (time, cost and scope) has been extended to different related variables, therefore, the project professional must be in ability to establish the requirements of the different stakeholders in order to establish success in the project that they must formulate, evaluate or execute.

With the development of this chapter some trends could be established for future research, these trends should be developed focused on determining the impact of different soft skills in the performance of projects by economic sectors. In the same way, it is necessary to be able to carry out research that determines the relationships between soft skills and the fulfillment of the business strategy of the organizations, the above responds to the fact that it has been established that project management supports the implementation of the business strategy, therefore It is necessary to understand the impact of soft skills in the strategic organizational performance.

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KEY TERMS AND DEFINITIONS

Communication: Communication in the context of soft skills are made up of a series of tools that allow to establish messages with others in a clear and effective way.

Competitiveness: Ability of private and public organizations to offer products or services that meet quality standards in local and global markets and thus ensure appropriate returns of profitability.

Critical Success Factors: They are variables that have characteristics and conditions that have a high impact on the effectiveness, efficiency and results of an organization, project or phenomenon.

Critical Thinking: It is a systematic process that conceptualizes, applies, analyzes, synthesizes and interprets information collected from various sources of information.

Hard Skills: Technical skills needed to perform a task or complete a job.

Leadership: Leadership is a process in which a manager’s influence is generated towards collaborators, so that they perform tasks voluntarily with a clearly defined objective.

Methodology: Methodology refers to ways of obtaining, organizing and analyzing data. Means or methods of doing something.

Motivation: Attribute or series of attributes that drives an individual or groups of people to perform one or a series of activities.

Negotiation: Negotiation is a process of agreement between two parties that have certain differences, but that try to reach an arrangement that satisfies them through the exploration of bidding options.

Problem Solving: Summary of the cognitive processes focused on the change of the given state to the final state where the solution procedure is not obvious. The given characteristics is among the experts of problem solving usually accepted.

Project: A unique set of coordinated activities, with definite starting and finishing points, undertaken by an individual or organization to meet specific objectives within defined schedule, cost, and performance parameters.

Project Management: Application of knowledge, skills, tools, and techniques to project activities to meet its requirements.

Project Performance: Evaluation measures of the results associated with the fulfillment of the objectives in a project.

Soft Skill: Interpersonal, human, or behavioral skills, necessary to apply technical skills and knowledge in the workplace.

Stakeholder: Any group or individual who can affect or is affected by the achievement of the organization's objectives.

Chapter 17

Sustainability Supply Chain Orientation Bibliometric Agenda

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ABSTRACT

The purpose of this document is to present the evolution of the supply chain with different points of view, from the perspective of the main authors on the subject, in order to show the benefits and difficulties faced in carrying out the sustainable orientation of the supply chain (SSCO). For this research, it is necessary to take into account from which point each of the definitions that helped reach the concept of SSCO was born and how the concept has changed over the years. It is interesting to note that currently the concept does not have a specific definition, because it is in a boom in recent years, which makes it an attractive topic to investigate and learn more in depth. In Colombia it has very few exponents of the subject. Therefore, researching SSCO can generate a competitive advantage in the industry for supply chains that compete in the interior and exterior of the country.

INTRODUCTION

The purpose of this chapter is to present the evolution of the supply chain with different points of view, from the perspective of the main authors on the subject, in order to show the benefits and difficulties faced in carrying out the Sustainable Supply Chain Orientation (SSCO).

For this research, it is necessary to take into account from which point each of the definitions that helped reach the concept of SSCO was born and how the concept has changed over the years. It is in-

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interesting to note that currently the concept does not have a specific definition, because it is in a boom in recent years, which makes it an attractive topic to investigate and learn more in depth, in Colombia it has very few exponents of the subject, so Therefore, researching SSCO can generate a competitive advantage in the industry for supply chains that compete in the interior and exterior of the country.

One of the key factors in this matter corresponds to market orientation that operates as an antecedent of strategic marketing management and a Supply Chain Orientation (SCO) that also functions as a history of Supply Chain Management (SCM) and all these criteria are a consequence of a Sustainable Supply Chain Orientation (SSCO) that improves the organizational performance of the logistics network (Beske *et al.*, 2014); (Signori and Flint, 2015).

The supply chain nowadays is taking relevance in companies due to globalization, production does not depend on a single geographical point, but companies need to improve their efficiency and seek to have the best relations with their suppliers and customers in order to ensure a flow of goods to the final consumer. Global competition is moving towards supply chains and how they are managed, however, they are focusing on just one factor, economic, neglecting the environmental and social factors that lead to the business can last in time ensuring complete sustainability of the supply chain. For this reason, it is important to be able to show the benefits of having a sustainable chain.

This document is intended to expose and publicize the evolution of the sustainability of the supply chain management orientation with different points of view from the perspective of the main authors on the subject, in order to show the benefits and weaknesses they face when carrying out the sustainable orientation of the chain of supply or by its acronym in English Sustainability in Supply Chain Orientation (SSCO).

For that investigation it was necessary to take into account a chronological analysis from which point each of the definitions that made it reach the concept of SSCO were born and how its concept has changed over the years, in addition to knowing about the authors They have published and the lines of research on the subject performing analysis of different bases of indexed articles. It is interesting to note that at present the concept does not have a concrete definition, because it is in a boom during the last years worldwide, which makes it an attractive topic to continue researching and knowing more thoroughly. In Colombia there are very few articles published in the face of this issue, this SSCO factor can generate a competitive advantage in the industry to supply chains that compete inside and outside the country.

Global competition is being directed to supply chains and how they are managed, however, these are focusing on only one factor that is economic, neglected environmental and social factors that lead to the business being able to endure in the time ensuring complete sustainability of the supply chain. For this reason it is the importance of being able to show the benefits of having a sustainable supply chain.

JUSTIFICATION

The research is born from the need to know the evolution that the supply chain has had up to the concept of Sustainability Supply Chain Orientation (SSCO), because in Colombia there is no knowledge about this concept which can contribute to the development of the industry as a competitive advantage. According to Srivastava (2007), based on the environmental dimension, he considers that it is a driver of the business and not a cost, (Min and Kim, 2012) proposed that the competitive advantages in the supply chains result from the corporate differentiation based on the positioning of the sustainability since this

translates into results for companies through cost savings, greater market share and a stronger brand positioning (Min and Kim, 2012)

Supported in bibliographic agendas to know the main authors, concepts, theories and models in order to show the benefits and challenges facing the supply chain based on the orientation to sustainability.

According Koberg and Longoni (2019) and Seuring and Gold, (2012) established that the search for the sustainability factor in supply chain management should include several phases within the search stories such as 1) material collection 2) descriptive analysis 3) category identification and 4) material evaluation.

Continuing with the above regarding methodology, consistent with previous reviews, we classified articles as conceptual, qualitative, quantitative or mixed methods. The articles that employ quantitative, qualitative or mixed methods for analyzing empirical data are the most prevalent in the reviewed literature and account for 85% of the total. The remaining 15% are conceptual articles.

According Koberg *et al.*, (2019) these initial categories were then inductively refined throughout the material evaluation step. The final analytic categories used to synthesize the content of the reviewed articles were thus abductively developed during the process of completing the literature review. As a result, SSCM configurations and SSCM governance mechanisms emerged from our review of the literature as key elements of SSCM in GSCs.

The Categories Overview and Description

Sustainability Outcomes: Describes adoption of environmentally and socially responsible practice and / or improvement of environmental, social or economic performance.

Sustainability Supply Chain Management Configurations: Describe the structural arrangement of supply chain actors and the linkages among them.

Sustainability Supply Chain Management Governance Mechanisms: Describe the relational mechanisms through which focal firms coordinate sustainability initiatives in their supply chains.

The sustainability of the supply chain management must be framed within the Supply Chain Orientation strategy where the suppliers of the suppliers and the other members of the logistics network are integrated, both the ascending process and the process descending where the organizational culture towards sustainability is instilled and controlled.

CONCEPTUAL DEFINITION OF SUSTAINABILITY SUPPLY CHAIN ORIENTATION

Currently the concept of SSCO does not have a specific definition given by an author, so based on the research carried out and having as input concepts such as Supply Chain Orientation (SCO), Supply Chain Management (SCM), Sustainability Supply Chain Management (SSCM) and Green Supply Chain Management (GrSCM); Sustainability Supply Chain Management (SSCO) would be defined as: The strategic integration of the supply chain oriented to environmental, economic and social considerations (Reefke, Ahmed and Sundaram, 2014) under the creation of a collaborative culture of knowledge and experiences among the partners that compose it generating a unique interaction that can not be imitated (Ocampo and Prada, 2017).

The adoption of sustainability for the solution of problems in the supply chains is one of the most dynamic research topics. In the first place, sustainability was related to the reduction of the environ-

mental impact caused by economic activities, which led to the creation of the concept of green supply chain management (GrSCM) (Martinsa and Patob, 2019). For Koberg and Longoni (2019) environmental sustainability includes the adoption of best environmental practices that include investments in pollution control and prevention, adoption of environmental management systems and environmental certifications such as ISO 14001. However, many authors consider the scope of sustainability in the supply chain under the guidelines of the GrSCM, notwithstanding the maturity of the research in the sustainable supply chain, it was important to include the social dimension (Martinsa *et al.*, 2019), which must contemplate compliance with the laws local labor standards and the adoption of social standards such as ISO 26000 in each of the levels that make up the supply chain (Koberg *et al.*, 2019). Elkington (1998) proposed that companies should not only be accountable on financial issues but that they should contemplate 3Ps, people, planet and profits, which is equivalent to the typical baseline that considers the Social, Environmental dimensions and Economics (Martinsa *et al.*, 2019).

An additional SSCM governance mechanism adopted by focal enterprises is to collaborate with other corporations, civil society organizations and other actors such as government, academia or unions to improve supply chain environmental, social or economic outcomes; and it has been labeled multi-stakeholder initiative (Liu, Zhang, Hendry, Bu, and Wang, 2018).

They found that according to Formentini and Taticchi (2016) they argued that buyers who strive to improve the environment, social and economic sustainability results use collaboration to relate to their relationship with suppliers. However, it is also evident that collaboration is not frequent; Buyers most often relied on evaluation to manage sustainability results in Global Supply Chain (Turker and Altuntas, 2014). Recent research related to the participation of the buying company in multi-stakeholder initiatives can help the burden of collaboration and support the adoption of providers of environmental and social practices (Vellema and Van Wijk, 2015). Few studies, however, have focused on multi-stakeholder initiatives.

In this order of ideas, the sustainability of the supply chain management must be linked to the new sustainability factor of the supply chain management orientation where the internal part of the network or the focal company begins to generate a culture towards efficiency both towards the flow towards the members of supplier management and for the management of customer relations for all types of companies, but more oriented towards SMEs. On the other hand, the sustainability factor has become a requirement for the improvement of the organizational performance of companies and perhaps another opportunity to adopt this type of initiatives in project management where logistics is integrated as an essential component for the planning, development, execution, control and monitoring for the operationalization of products and services. There are innumerable uses that can be offered to companies and organizations in the logistics field included up to the NGOs for the improvement of the promise of value offered to interest groups where it could be very interesting to be able to materialize these business trends in the sector public in Colombia that sooner or later should adopt.

BACKGROUND AND THEORETICAL FRAMEWORK

The supply chain has had a constant evolution in recent years and this has led to new concepts complementing the definition, generating added value for all stakeholders through efficiency and effectiveness, however it is important to know each of the concepts that have added value (Martinsa *et al.*, 2019).

The supply chain is based on a flow of processes and activities whose purpose is the satisfaction of the client's needs, this flow that can be of different characteristics such as information, products or cash, which generate costs as they move around the chain and it the only source of income is the final customer. Thanks to globalization, access to information and cooperation between borders, generates that business networks and the supply chain are global (Ocampo *et al.*, 2018), is also defined as the association of three or more individuals or organization that exchange products, finances and / or information from a source to a client (Matsuno, Ken, and Mentzer, 2000). The importance of supply chains is due to the competition found in the market since having an efficient flow ensures that it can compete not between companies but between supply chains, which is the form of competition currently (Ocampo *et al.*, 2018).

The supply chain management (SCM), this concept was introduced in 1980 and what it seeks is to effectively and effectively manage each of the processes and activities from product development, marketing, production operations, distribution, finance and customer service. (Ocampo *et al.*, 2018). Also the concept of Supply Chain Orientation arises that according to Tinney (2012) defines it as the capacity that an organization has to establish and maintain a relationship with its supply chain partners, based on collaboration, knowledge and experiences and that can not be copied by organizations in the same sector (Ocampo *et al.*, 2018). For (Esper, Defee, and Mentzer, 2010), the supply chain orientation represented a shared value and a belief system that has the purpose of helping the organization to strategically manage its supply and the norms of behavior within the organization, taking to see the supply chain in a holistic way in order to seek integration, synchronization and convergence of operational activities and strategic capacity (Esper *et al.*, 2010). From there the supply chain begins to take into account other aspects that affect the processes and activities, these factors are environmental and social and that lead to the concept evolves to a sustainable management.

In recent years, environmental accidents such as oil spills, atomic material disasters such as Chernobyl, forest fires among others have led Stakeholders, regulatory bodies, industry and consumers to consider business models, questioning the processes and practices used and the impact it has on society and the environment (Rajeev, Pati, Padhi, And Govindan, 2017). The need for changes in the practices implemented by industry and consumption patterns began when Brundtland Report was published in 1987 by the World Commission on the Environment in the Kyoto Protocol (Dehghanian and Mansour, 2009). Academic interest in sustainability in supply chains is reflected in a 61% increase in articles published after 2010 (Koberg and Longoni, 2019) and is focused as a tool for solving environmental problems without neglecting the other variables that make up sustainability, taking into account that the government exerts pressure and control over the technology and processes used in the production of goods. (Rajeev *et al.*, 2017) It is important to highlight an important interest group that has taken on a daily basis in the consumption patterns of the market are the final consumer (Koberg *et al.*, 2019).

To understand the scope of sustainable development the concept of this must be understood, according to the World Commission on Environment and Development: "A development that meets the needs of the present Without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987), in order to obtain sustainable development, policies and actions must contemplate that economic growth be in tune with the environment and be socially equitable (Miren, 2002). Sustainable production practices and consumption patterns in the management of natural resources and the eradication of poverty. This led to the creation of a concept through the production of social, environmental and economic studies and research that is known as the triple bottom line of sustainability (Joyce and Paquin, 2016). Because this boom in developed countries regulations became more stringent so not to sacrifice their economic sustainability decide to bring their

most polluting processes to developing countries where regulations are more flexible sacrificing social and environmental sustainability of these countries, but without making a change but the problem moves from geographical location, however due to pressure from the market and stakeholders, it begins to consider a sustainable or green management in which priority is given to reducing costs, increasing efficiency and the improvement of internal and external customer satisfaction (Rajeev et al., 2017). This problem led to the generation of a new concept called Green Supply Chain Management according to Srivastava (2017), which defines it as:

Integration of environmental thinking in the management of the supply chain, including the design of the product, the obtaining and selection of materials, the manufacturing processes, the delivery of the final product to consumers and the management of the end of the useful life of the product after its useful life (Srivastava, 2017, p. 72)

However, there is a shortcoming in GSCM since it only focuses on conserving the viability of natural resources and economic benefits but neglects the social component, so the concept evolves into Sustainable Supply Chain Management according to Ahi and Searcy (2013) defines it as:

The creation of coordinated supply chains through the voluntary integration of economic, environmental and social considerations with key inter-organizational business systems designed to efficiently and effectively manage the material, information and capital flows associated with the acquisition, production and distribution of products or services to meet the requirements of the interested parties and improve the profitability, competitiveness and resilience of the organization in the short and long term (Ahi et al., 2013, p. 335).

Based on a bibliographic analysis on SSCM, three important phases stand out. The first phase is prior to the implementation of the Kyoto protocol, which was carried out on December 11, 1997 but entered into force on February 16, 2005, in the which was agreed the reduction of greenhouse gases and the emission of Co2. In this first phase, business models were driven by economic benefits. The second phase begins with the implementation of the Kyoto protocol with the developed countries where there is a significant increase in studies compared to the underdeveloped countries. The third phase began in December 2009 with the climate council in Copenhagen, during that period of time there were several environmental accidents such as the oil spill in the Gulf of Mexico, which increased academic attention to the SSCM growth occurred in developed as underdeveloped countries.

In the evolution of research on sustainability in the supply chain developed countries have shown greater progress and evolution as they lead the production of knowledge with 59% of research Developed countries have a higher human development index, regulations more and an industry that is at its peak, which has led them to worry about the environmental and social benefits in order to achieve full sustainability, however in underdeveloped countries because the level of their Industrialization is not so high and the level of access to data is low, the level of research in SSCM is low (Rajeev et al., 2017).

The following graph illustrates the growth of the production of articles related to SSCM from 2000 to 2015, which corroborates the fact that the Developed countries are the ones that have paid the most attention to the SSCM, as well as a significant growth of the Literature from 2011 in important journals such as International Journal of Production Economics (JPE), International Journal of Psychological Research (IJPR), European Journal of Operational Research (EJOR), International Journal of Physical

Distribution & Logistics Management (IJPDL). This increase can be related to the increase in regulation, the knowledge and pressure of customers on the environmental and social impact, this trend is infecting the underdeveloped countries that in the same period of time has increased its production of articles in a lower growth rate.

The largest number of articles was published in the International Journal of Production Economics, with a total of 101 articles, the areas in which SSCM was discussed are diverse in which operations, marketing, economy, administration among others are highlighted. It is highlighted that most of the articles made the comparison between developed and underdeveloped Economies, this could be due to the lack of data access as mentioned above.(Rajeev *et al.*, 2017). According to the type of methodology used in the research carried out in the same period of time, it is shown that the construction pattern of a theory is followed where the conceptual work is followed by empirical validation, applying it to use cases, which finally results in the creation of a mathematical model that is used to solve a specific problem. (Rajeev *et al.*, 2017) The industries in which more research was developed based on the data provided is the electronic industry with 19.5%, then the agricultural food industry with 17.5% and finally the automotive industry with 12.6%, however in industries such as metallurgical, chemical, petroleum refining, tanneries among others, which produce the most waste (Jimenez, 2018) there are very few studies that address them in developed countries as in the developed, what would be a research opportunity (Rajeev *et al.*, 2017).

Classifying the research carried out from 2000 to 2015 and taking as reference the definition of sustainability in its three dimensions (Economic, Environmental and Social), it is highlighted that the economic factor is the one that is most considered in research with a total of 1019 articles, followed by the environmental factor with 779 and finally the social factor with 222. It was taken into account when combining one or more dimensions.

Sustainable management in global supply chains is a challenge for large companies due to the geographic distance between buyers and sellers and the different levels that make up the supply chain, generating a challenge to ensure sustainability at each level, because that managers can not have visibility beyond first-tier suppliers, the importance of sustainability in the global supply chain includes government entities, suppliers, shareholders and customers due to the importance, size of the companies that they compose it and the visibility they have before the market (Koberg *et al.*, 2019).

During the bibliographic review carried out by Koberg and Longoni (2019), different types of configuration that the SSCM supply chain can have were established based on the structure of the participants in the supply chain. The first configuration, which is the most common, is where the buyer only has a relationship with the first level provider and does not have a direct link with the sub-suppliers (Koberg *et al.*, 2019), the second configuration is proposed by Mena, Humpries and Choi (2007) known as open SSCM, is that the most relevant companies make efforts to extend sustainability to first level suppliers and they are responsible for extending it to their own suppliers, it is done through third parties in which the most relevant companies collaborate with non-economic actors such as NGOs to train and transmit good practices to all suppliers in order to improve the results in each of the lines that make up sustainability. (Mena, *et al.*, 2007) finally establishes the closed configuration that is characterized by buyers who establish formal links with top-level suppliers as well as with their sub-suppliers where they are responsible for managing the sustainability results by formal or informal means leading the sustainability ascending the supply chain.

There are also 3 governance mechanisms for the application of sustainable management of the supply chain (SSCM), according to the literature review carried out through the evaluation of articles on

sustainability of global supply chains (GSC) and sustainable management of the supply chain (SSCM) the first mechanism of government is characterized by the collection of information to monitor and evaluate the environmental and social performance of the supplier evaluating its code of conduct, this mechanism is classified as the supplier's evaluation. The second mechanism of government consists in the communication, knowledge and training of the suppliers in order to improve their environmental and social performances. It is known as collaboration with the provider. Finally, the third governance mechanism is known as multi-stakeholder initiatives and consists of collaboration between corporations, NGOs, government entities, the academy, trade unions and others in order to improve the environmental, social and economic results of the supply chain (Koberg *et al.*, 2019).

The sustainability in the supply chain orientation is contemplated in which all the members of the supply chain internalize the sustainability from the organizational culture with a reach from the suppliers and suppliers of the suppliers where as mentioned mentzer in many publications after 2001 until 2010 and which was later retaken by Tucker and others, dimensions such as credibility, cooperative norms, commitment, management support, benevolence and compatibility, should be permeated as parents to children in this case of the focal company or the internal part of the network towards the management of the suppliers including tier 1, tier 2 and others. On the other hand, value networks are faced with a continuous collaborative work between customer-provider where upstream flows become a key inbound so that the network fulfills a satisfactory mission from the beginning of the product's life cycle the needs not only of customers but of interest groups.

According to (Jadhav and Orr, 2018) carried out an SEM analysis with the data carried out through surveys of supply chain leaders where it was evident that the construction of the supply chain orientation work team had an optimal communication where it affected the environmental supply chain and the sustainability performance.

METHODOLOGY

The methodology used in the work was of secondary information sources supported by bibliometric agendas and scientific articles related to sustainability and the supply chain. Topics were evaluated such as Supply Chain Orientation (SCO), Supply Chain Management (SCM), Sustainability Supply Chain Management (SSCM), Green Supply Chain Management (GrSCM), Sustainability in Global Supply Chain (GSC) and Sustainability Supply Chain Orientation (SSCO). The search was carried out in academic databases such as Scopus, web of Science, Elsevier, Jstor and Emerald Publishing, as well as searches carried out in Google Scholar and supported by articles published in Researchgate.

EVOLUTION OF SSCO THROUGH TIME

Below is the evolution of the Sustainability Supply Chain Orientation based on all the articles that contribute to the formation of the concept presented in this paper, showing the methodology used and the relevant findings mentioned. See table 1. SSCO Bibliographic Review.

Angeles and Nath, (2001) made a difference in the evolution of the concept of supply chain management where flows, raw materials, labor and capital, were very focused on the multifunction of areas and processes in the organization.

Sustainability Supply Chain Orientation Bibliometric Agenda

Table 1. SSCO bibliographic review

Authors	Title	Methodology	Main findings
(Angeles and Nath, 2001)	Defining Supply chain Management	Theoretical analysis of the evolution of the supply chain concept	The article shows the evolution of the supply chain concept, the interaction it has with each of the flows that an organization has (information, raw material, labor and capital). Presents the concept of SCM compared to its predecessors and shows the results that are obtained when implementing it in organizations
(Esper <i>et al.</i> , 2010)	A Framework Of Supply Chain Orientation	Literary review	The research purpose is integrate several definitions of supply chain orientation and contribute elements to this definition, including areas of organizational design, human resources, information technology and organizational measurement.
(Reefke, Ahmed, and Sundaram, 2014)	Sustainable Supply Chain Management - Decision Making And Support: The SSCM Maturity Model And System	System for creating sustainability models and reports	The article focuses on decision-making at managerial levels to bring sustainable management of a supply chain and proposes a multi-layered model to bring sustainability from beginning to end in the supply chain
(Pagell and Shevchenko, 2014)	Why Research In Sustainable Supply Chain Management Should Have No Future	Investigative article	The Article shows a different view on the implementation of sustainability in supply chains due to the lack of knowledge and innovation. And finally, it provides recommendations that contribute to having a true sustainability in the supply chain
(Martínez-Jurado and Moyano-Fuentes, 2014)	Lean Management supply chain management and sustainability: A literature Review	Bibliographic review	The objective of the article is to evaluate the links between Lean Management, supply chain management and sustainability. We identified the set of topics and studies that contributed to the bibliographic review and the empirical evidence that is available for future research.
(Meixell and Luoma, 2015)	Toward Sustainable Supply Chain Orientation.	Grounded theory and Phenomenology	The main objective of the document is to provide information on how the executives of a specific industry, in this case about wine, perceive sustainability and the relationship that may exist between the management of the supply chain. In addition, the introduction of the concept of the orientation of the sustainable supply chain, developed profiles of the executives with respect to the perspectives and positions they have with respect to the SSCO.
(Fahimnia, Sarkis, and Davarzani, 2015)	Green Supply Chain Management: A Review And Bibliometric Analysis	Bibliographic review	The purpose of the article is to carry out a bibliographic review of the green management of the supply chain. The analysis was made based on 1000 articles related to environmental sustainability
(Vintage and Scott, 2016)	Sustainability Orientation And Competitiveness: Is Supply Chain Consideration A Missing Link?	Data supplied by the chemical industry	Research focuses on the relationship between sustainability and competitiveness. At the supply chain level, it shows the positive effects on price, quality and product innovation capacity that depends on the orientation of the supply chain.
(Hsu, Tan, and Mohamad Zailani, 2016)	Strategic Orientations, Sustainable Supply Chain Initiatives And Reserve Logistics: Empirical Evidence From An Emerging Market	Research carried out in emerging countries with empirical data	The research shows by means of empirical methods the results that the application of sustainability in the supply chain can have, using data from emerging countries.
(Ocampo and Prada, 2017)	<i>Orientación A La Cadena De Suministro Y Su Relación Con Diferentes Grupos De Interés</i>	Bibliographic review	The purpose of the article is to make a bibliographic review of the contributions worldwide on the orientation to the supply chain and show improvement in productivity and business competitiveness.
(Kuo <i>et al.</i> , 2017)	Investigating The Influential Factors Of Sustainable Supply Chain Management, Using Two Asian Countries As Examples	Research conducted with data from Industries in Taiwan and Vietnam	The objective of the research is to identify the factors that influence in a conceptual and practical way when applying the sustainable management of the supply chain. The study was conducted in Taiwan and Vietnam
(Rajeev <i>et al.</i> , 2017)	Evolution Of Sustainability In Supply Chain Management: A Literature Review	Bibliographic review	The article analyzes the evolution of sustainability problems by analyzing the trends of industries and economies under the concept of SSCM.
(Emamisaleh and Rahmani, 2017)	Sustainable Supply Chain In Food Industries: Drivers And Strategic Sustainability Orientation	Investigative article	Internal and external initiatives are examined to study strategies of orientation to the sustainable supply chain in the food industry in Iran.
(Gurtu, Searcy, and Jaber, 2018)	Transportation And Sustainable Supply Chains	Bibliographic review	The article provides an overview of sustainable supply chains, transport, and links between them, and describes the key issues in transport and supply chains. It provides an overview for Managers and Executives on how to adopt this theory and implement it; and to academics as a line of future research.

Then (Esper *et al.*, 2010), the contributions related to the orientation of the supply chain vary according

Authors	Title	Methodology	Main findings
(Ocampo and Prada, 2018)	<i>Orientación A La Cadena De Suministro Y Su Relación Con La Gestión De Proveedores, Una Revisión Bibliográfica</i>	Bibliographic review	The purpose of the research is to show the relationship between the orientation to the supply chain and the management of relations with suppliers seeking to improve productivity and business competitiveness
(Morita, Machuca, and Pérez Díez de los Ríos, 2018)	Integration Of Product Development Capability And Supply Chain Capability: The Driver For High Performance Adaptation	Study carried out with primary research with data obtained in fourteen countries.	The article focuses on how to approach the dynamic circumstances of the market in the life cycle of the product and the relationship it has with the orientation of the supply chain when coordinating the capacities for change.
(Kang and Moom, 2018)	Influence Of Supply Chain Orientation On Supply Chain Performance Through Dynamic Collaboration Capability	Statistical analysis of data collected in South Korea.	This research shows the impact of Supply Chain Orientation (SCO), Dynamic Collaboration Capabilities aimed at increasing the performance of the supply chain. Assessing the strategic SCO and the structural SCO in the performance of the supply chain.
(Jadhav and Orr, 2018)	The Role Of Supply Chain Orientation In Achieving Supply Chain Sustainability	Factorial Analysis.	This research seeks to determine the complete relationship between the internal coordination of the supply chain and the internal practices of sustainability of the supply chain, creating different hypotheses regarding environmental sustainability and social sustainability.
(Jia, Gong, and Brown, 2018)	Multi-Tier Sustainable Supply Chain Management: The Role Of Supply Chain Leadership	Research in multinational supply chains	A multi-case study was designed. Multilevel supply chains of three multinational companies were selected to investigate their proactive sustainability projects in China. A framework based on the constructs of the supply chain was proposed.
(Bastas and Liyanage, 2018)	Sustainable Supply Chain Quality Management: A Systematic Review	Bibliographic review	The article carries out a bibliographic review on two management methodologies, the first the management of sustainability from an intraorganizational approach and the management of the supply chain with an interorganizational vision. The inclusion of sustainability in the supply chain was identified as a highly emerging area in research and application in the business.
(Jia, Zuluaga-Cardona, Bailey, and Rueda, 2018)	Sustainable Supply Chain Management in developing countries: An analysis of the literature	Bibliographic review	The article provides a literature review of SSCM in developing countries in which four factors related to the adoption of SSCM were identified: drivers, barriers, mechanisms and results.
(Ghadimi, Wang, and Lim, 2019)	Sustainable Supply Chain Modeling And Analysis: Past Debate, Present Problems And Future Challenges	Bibliographic review	The article carries out a bibliographical review based on articles on Resources, conservation and recycling in the supply chain, as a result the need for the implementation of a sustainable supply chain is shown.
(Koberg and Longoni, 2019)	A Systematic Review Of Sustainable Supply Chain Management In Global Supply Chains	Bibliographic review	The article is based on a bibliographic review of SSCM applied to the global supply chain, due to the difficulty that is presented to transfer sustainability to each of the links that compose it.
(Martinsa and Patob, 2019)	Supply Chain Sustainability: A Tertiary Literature Review	Bibliographic review	The systematic review of 198 surveys published between 1995 and 2018. The objective is to answer three research questions: what are the existing bibliographic reviews on the sustainability of the supply chain, what its methodological characteristics are and what are its main objectives and subjects.
(Rebs, Brandenburg, and Seuring, 2019)	System Dynamics Modeling For Sustainable Supply Chain Management: A Literature Review And Systems Thinking Approach	Investigative article	The article provides a review of system dynamics models related to SSCM from the perspective of systems thinking and proposes guidelines for the modeling of dynamic systems.
(Tseng, Islam, Karia, Fauzi, and Afrin, 2019)	A Literature Review On Green Supply Chain Management: Trends And Future Challenges	Bibliographic review	The article presents a bibliographical review on management of the green supply chain, in order to present ideas and directions for future research
(Huo, Gu, and Wang, 2019)	Green or lean? A Supply Chain approach to sustainable performance	Investigative article	The article shows a comparison between the Green or Lean concepts, evaluating the part of the client and the part of the supplier, in order to validate the environmental, social and economic performance.
(Seuring, Brix-Asala, and Khalid, 2019)	Analyzing base of the pyramid projects through sustainable supply chain management	Investigative article	The purpose of the article is to validate if the SSCM theory is applicable to pyramid-based projects, data were collected empirically in two African countries (Kenya and Uganda), the results show that the pressure of the clients drives the companies to associate with third parties that are involved in auditing suppliers in order to ensure complete sustainability.

Source. Own Elaboration

to the application of the inter-functionality of the areas, the human resource, the information technologies and the performance begins to be known organizational, however there is not much important based on sustainability. On the other hand, stories such as the case of (Martínez-Jurado and Moyano-Fuentes, 2014); (Fahimnia *et al.*, 2015) where more than 1000 articles related to sustainability are analyzed are very relevant environmental and where the integrative role between lean manufacturing, supply chain management and sustainability is evaluated, in addition to generating specific profiles for the subject in question.

(Rajeev *et al.*, 2017) made an analysis of the evolution of sustainability problems in industries and in countries under the Sustainability Supply Chain Management (SSCM) factor.

(Ocampo *et al.*, 2018) made an analysis of the different links that the supply chain orientation has in the value network and (Jadhav *et al.*, 2018) made an analysis of the operational behavior of the internal areas involved under the criteria of sustainability.

In addition to the above (Bastas and Liyanage, 2018), presented the bibliographic review where it has two methodologies, the first one refers to the management of sustainability from an intra-organizational scope within the supply chain management as an inter-organizational vision. It is striking that sustainability is a highly emerging area in the field of business.

(Ghadimi, Wang, and Lim, 2019) mention that conservation resources and the recycling process in the supply chain is the result of the needs of sustainability in value networks.

(Martinsa and Patob, 2019), carried out a literature review of 198 articles published between 1995-2018, and determined which articles had the main objectives and methodologies in sustainability.

Finally (Tseng, Islam, Karia, Fauzi, and Afrin, 2019); (Huo *et al.*, 2019); (Seuring, Brix-Asala, and Khalid, 2019) presented a bibliographic analysis based on the factors of Green supply chain management and future research in the field of research.

As seen through the document, sustainability in the orientation to supply management is a factor of great interest both at the international level and at the level of Colombia, because it is a great opportunity for leaders in the field of logistics and management of projects to adopt these types of strategies not only to think individually of companies but also to be a fundamental maxim for all members of the business group to deploy the strategy from the supplier's provider to the client's client, improving performance organizational and where a better planet is preserved for the human being.

On the another hands, the literature has suggested that it is time to consider the effect of SCO on Supply Chain Sustainability Performance (SCSP) (Chen *et al.*, 2017).

Supply Chain Orientation is also affected by a number of organizational characteristics including organizational size, culture, structure and management decision making (Esper *et al.*, 2010; Min, Mentzer, and Ladd, 2007) as they all influence the alignment of the organization toward the supply chain and the resources available.

SSCO Variables

The main variables that were analyzed in the social dimension include ethical supply chains, equitable treatment of stakeholders, education, training, social justice and diversity. In the environmental dimension, the most studied variables are Co2 emissions, the use of natural resources and waste management. In the economic dimension are considered profitability, profits, projection of the business among others. (Martinsa and Patob, 2019).

Both the factors in the social and environmental field are increasingly taking greater participation in research worldwide where there is greater equity in activities within the management orientation of the supply chain and that is where the commitment of the groups of Interest takes on greater prominence because the customer is no longer thought about but rather the demands of the interest groups and is considered as a holistic system that needs to be controlled for the improvement of the overall performance of the network.

The model of structural equations developed by Jadhav *et al.*, (2019) shows the relationship that they identified from the data collected in five manufacturing sectors, different from the manufacturing sectors, since they sought to collect data from each of the levels that make up the supply chain.

From the data collected were identified five constructs that represent variables that influence the application of sustainability in the supply chain.

1. Internal coordination of the supply chain: Evaluates the activities of SCO that integrate the capacity of the organization to manage its responsibilities of the internal supply chain, allows the planning and allocation of resources in each of the stages of the internal chain, seeks to improve the performance of the capacity internal and ensures cooperation between members of the internal supply chain. (Jadhav *et al.*, 2018).
2. Collaboration and communication: It establishes communication with the supply chain and provides the necessary information to support joint decision making, and must ensure that the objectives that are raised must be known to all members of the supply chain. (Jadhav *et al.*, 2018).
3. Internal practices of sustainability in the supply chain: It contemplates the practices or processes that affect the contribution that it has to the sustainability of the supply chain, for which reason it must be clear the guidelines of the internal sustainability policies. (Jadhav *et al.*, 2018).
4. Performance of environmental sustainability in the supply chain: The performance of the supply chain as a whole is evaluated in terms of results and not practices, among the variables that are taken into account are energy consumption, waste reduction, consumption of resources, reduction of emissions of CO₂ among other variables. (Jadhav *et al.*, 2018).
5. Performance of social sustainability in the supply chain: Evaluates the performance of the supply chain as a whole in terms of results and not practices, variables such as the reduction of child employment in the supply chain, reduction of work practices in bondage conditions, compliance with social regulations are contemplated and commitments to the community where members of the supply chain are among others. (Jadhav *et al.*, 2018).

The respondents identified a strong correlation between two constructs: the internal supply chain coordination and External supply chain sustainability performance, this shows that the internal coordination of the supply chain such as collaboration and communication are positively and significantly related with the internal practices of sustainability, while the internal practices of sustainability in the supply chain are related to the performance of environmental sustainability; collaboration and communication influence the performance of external social and environmental sustainability.

In the structure of the SCO, the internal coordination of the supply chain focuses on the activities within the organization and how they improve the supply chain; while collaboration and communication of the supply chain has an external focus focusing on activities with actors that make up the supply chain at the macro level. Therefore, these two factors have different effects because their individual relationship with the internal practices of the supply chain must be considered in an independent manner, on the

other hand it is also likely that the levels of internal coordination of the supply chain of the organization are affected by features such as size and decision making. (Jadhav *et al.*, 2018).

There are several perspectives in the supply chain orientation, one is the strategy and another is the structure. The first refers to generating a vertical integration between the relationships with suppliers and the management of customer relations, but the main component is the focal company that functions as the internal part of the supply chain that is the integrating hub component.

The second structural perspective relates to the essential components of supply chain management, as (Chopra and Meindl, 2013) has stated in the literature. The essential processes are planning, sourcing, production, delivery or distribution and reverse logistics. However, the number of processes established for companies will correspond to the particular needs of each one. There will not be an exact number determined for the logistic processes but it will be based on the particular need of each organization.

One of the most interesting findings is that while the internal coordination of the supply chain has a significant effect on sustainability practices in the supply chain, it has no effect on the external environmental or social supply chain; This means that the internal supply chain is a significant contributor to the development of internal resources. (Jadhav *et al.*, 2018).

The effects of collaboration and communication in the supply chain make an important contribution to the literature by determining that it has a significant effect on two types of sustainability performance. The SCO construct has a relationship with the external supply chain, this shows that SCO can have a direct relationship between the decision and the performance of sustainability in the external supply chain; this makes a contribution to the literature that shows that today the SCO has focused and has been shown as an effect of the organization instead of a decision variable. This shows how there is a relationship between the decision area and the performance of the supply chain literature and significantly increases the scope of future research on this topic. (Jadhav *et al.*, 2018).

It is important to note that the concept of collaboration and communication of the supply chain not only directly affects the performance of the sustainability of the external supply chain but also affects the internal operational concept of sustainability practices of the internal supply chain. (Jadhav *et al.*, 2018).

CONCLUSION

The concept of Sustainability Supply Chain Orientation has positive implications for the supply chain since, as mentioned by Min and Kim, (2012), supply chains are currently measured in terms of efficiency and sustainability, which is why the application of SSCO in the current supply chains represent a competitive advantage with respect to the market, since as mentioned in the research carried out the concept evolved from Sustainability Supply Chain Management and although there is currently no main exponent, the research focuses on showing the background and the implications in practice.

It is important to measure the challenge that supply chains have, since when applying SSCO, they must create transparent and trustworthy relationships so that the communication and application of each one of the component variables are applied to each of the levels of the supply chain. catering. Due to this, there are some barriers or difficulties such as the lack of knowledge and management of the suppliers of the suppliers, the transparency of the information regarding the compliance with the social and environmental sustainability indicators along the supply chain (Koberg and Longoni, 2019). That is why the implementation of the SSCO must start within the organization managing the internal supply chain, applying sustainable processes in the environmental, social and economic dimensions,

in addition to carrying out communication and collaboration of each of the departments involved; The most representative printed companies in the supply chain must exercise leadership over their suppliers to share information and knowledge in order to establish best practices. In addition, they must establish evaluation methods to measure the results of sustainability in the supply chain.

Regarding future research, it is important to thoroughly investigate the implementation of the SSCO based on success cases, and also to evaluate new variables that allow the construction of new constructs that facilitate the understanding of the SSCO and the knowledge of the environmental and social performance of external supply chain.

This sustainability factor in the supply chain management orientation cannot become a fad within business philosophies but on the contrary it must become a materialization of an entire organizational culture that not only seeks its own benefits but also integrates a whole series of companies above and below the logistics network that contributes to the improvement of the requirements and benefits of interest groups. It can not be forgotten that everything starts from the market orientation that acts as an antecedent to the supply chain management orientation and this in turn is the process before the supply chain management finally culminating with the supply chain performance, but where the basic philosophy is sustainability for the needs of stakeholders.

Another of the key components that makes the different activities within the sustainability in the supply chain orientation materialize is that the different logistics plans are developed, framed in the different plans such as: the short-term operational plan (of the day a day until the year), the tactical plan, medium term (1 to 3 years) and the strategic plan, long term (3 years and up) where through the strategy of total order fulfillment and process management the needs are controlled particular interest groups. All of the above will improve the performance not only of tier 1, tier 2 but that the entire internal part of the network will improve the interfunctionality corresponding to the areas and processes where the management of purchases will ensure an effective organizational purchase for the whole network.

Finally, there is a very interesting reflection that consists in the fact that the sustainability factor is a very important item to take into account when creating supply networks where the management orientation of the supply chain is integrated before the adoption of the supply chain management where market orientation is taken into account and where everything comes together in supply chain performance for the realization of the needs of stakeholders and Colombia is no exception for this type of research.

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KEY TERMS AND DEFINITIONS

Supply Chain Management: The essential processes are planning, sourcing, production, delivery or distribution and reverse logistics. However, the number of processes established for companies will correspond to the particular needs of each one. There will not be an exact number determined for the logistic processes, but it will be based on the particular need of each organization (Chopra & Meindl, 2013).

Supply Chain Orientation: Represented a shared value and a belief system that has the purpose of helping the organization to strategically manage its supply and the norms of behavior within the organization, taking to see the supply chain in a holistic way in order to seek integration, synchronization and convergence of operational activities and strategic capacity (Esper et al., 2010).

Sustainability: Is a challenge for large companies due to the geographic distance between buyers and sellers and the different levels that make up the supply chain, generating a challenge to ensure sustainability at each level, because that managers cannot have visibility beyond first-tier suppliers, the importance of sustainability in the global supply chain includes government entities, suppliers, shareholders and customers due to the importance, size of the companies that they compose it and the visibility they have before the market (Koberg et al., 2019).

Sustainability Outcomes: Describes adoption of environmentally and socially responsible practice and/or improvement of environmental, social or economic performance.

Sustainability Supply Chain Orientation: The strategic integration of the supply chain oriented to environmental, economic and social considerations (Reefke, Ahmed, & Sundaram, 2014).

Chapter 18

Communication for Cultural Project Teams: How to Use Digital Tools

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ABSTRACT

The projects developed by cultural companies represent important challenges in communication, which were identified through an exploratory study with a mixed approach applied in the Puebla, Mexico area. In this study, 21 cultural organizations were identified, which were categorized into three levels depending on the maturity of their business processes. They inquired about how they are using digital tools in cultural projects. They identified the use in internal communication, the use in external communication, and the control phase in projects. The results show that although some projects are already using digital tools, they should still work on the implementation of strategies that improve the effectiveness of the results of cultural projects.

INTRODUCTION

By understanding that communication is a complex phenomenon that affects work teams, we face a new challenge: the reconfiguration of new digital tools. This new environment allows the cultural organization to be understood as a system that requires information flows for the generation of consensus, understanding and understanding; that is, communication.

Considering the above, this document aims to understand how cultural organizations identify, build and develop channels, tactics, actions and activities with digital tools, achieved that are useful to the

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cultural organization for the concretion of communicative logic; linking the internal structure with the environments and public in an efficient and effective way..

BACKGROUND

Communication and Projects

Communication is the basis of social relationships. The processes of communication involve, before anything else, the interactions between subjects, related issues, and empirical links in the world of everyday life. This is nothing other than the actions aimed at the recognition of the other, with which we interact from our own worldview and the recognition of the character of a person similar to oneself (Rizo cited in Rizo, 2012, pp. 23-24)

A more detailed analysis allows identifying epistemological particularities of the communication that is proposed throughout the text. The first thing that can be done is to take into account the interrelation with someone else. Second, there must be willingness in both cases to generate communication and to seek understanding from the actions of daily life. By recognizing the other as one similar to him, he will be given the point of the capacities and values with which each one recognizes himself and can be linked to him. Third, the experiences that have been formed as individuals, the subjectivity and perception of the world, the arguments that are used to interact with one another. Fourth, this correlation, interaction, flow of information and understanding is what allows the construction of the human being and the culture itself.

The Complex System of Communication in Project Teams

The discussion about communication also involves the epistemological foundations that, as a legacy, allow us to understand the complexity of human interaction, the producer of meanings. This relationship with the cultural axis in turn gives meaning to the social world. That is, we speak of a cyclical process that, regardless of the means or tools, at all times reconfigure the emotions, perceptions, desires and identities, briefly, the richness of the symbolic life of human culture.

Social recognition of the importance of the communication phenomenon and the different processes that favor the constitution of everyday reality are increasingly visible (Navarro, 2002). In a dynamic world, the phenomenon becomes more complex, it is not enough to determine actors, channels or messages, it is necessary to reconsider mental structures, contexts, tools, subjectivity and action. This relationship that is lived in daily life should be transferred to organizations; what is understood as the simple transmission of information between the members of a company is not enough.

The actions on the communication of the companies must take into account all the aspects that we have already commented. That is, the strategy as a methodology of change, must consider the structures of the subjects, contexts and actions; Exceeding the traditional sender, channel, code and receiver model. Suffice to say that all interactions are presented in social spaces.

A construction that provides, a way of a map or a scheme, a vision on the set of points from where the ordinary agents direct their looks to the social world; A representation of the location or position of each individual or social agent occupies this space in relation to the others (Maass, 2006).

This multidimensional space is constituted by a multiplicity of actors, desires, interests, cosmovisions, needs and perspectives; What you must reconsider on the one hand is communication as a heterogeneous phenomenon in organizations; and on the other hand, the way in which it is managed. Thus, communication strategies should no longer be a series of steps. Now we must analyze cultural, intersubjective and contextual aspects for the strategy of the material and symbolic dimensions, especially in digital environments.

Communication Processes in Cultural Project Teams

The communication processes will occur as a result of working communicative strategies from the cultural dimensions of the context, for this it is necessary to identify the communication processes and link them with the work of the project team.

The development takes place from the sociocultural meeting of the members of the project team, which seeks to share the meanings to transform the individual and social environment and the processes or strategies are progressive according to what the environment needs. Thus, development does not take place at macrosystemic levels but in local contexts, in everyday spaces of discussion and work, in the exchange of meanings, in the generation of symbolic forms, mixing modern methods based on technology and traditional methods centered on in culture and subjective needs (Vásquez, s / f).

“Communication is a powerful weapon that enables the narration and visibility of the field of culture in all fields” (Maass, 2006, p.69), that is, the everyday contexts in which individuals submerge. Organizations are part of everyday contexts, people build and socialize their world of life inside and outside of them. Therefore communication is present at all times. There is no management, relationships, fields of culture or spaces of interaction in which there is no communication. And in the field of organization, we must talk about organizational communication or communication strategies.

These should consider the three categories of order that will allow designing action and work strategies. On the one hand, first-order communication that has to do with face-to-face interaction, the body is the main tool. The second order communication in which a tool is used to extend the scope and effect of the message. And the communication of third order in which the communicants need technological supports to be able to interact (Maass, 2006). When we refer to development strategies, we will find that the three categories can be linked in the actions of the social actor or the cultural organization. Either by direct interaction or by the use of symbolic products or technological tools, it will be considered as a communicating actor that will seek to interrelate with the rest of the community.

Communication in Digital Environments

It is a fact that the communication theory is not yet finished, the sociological rupture implied the conceptual and epistemological elaboration of its own. To the latter, authors like Serrano consider it an intellectual challenge that fills the gaps in communication and other sciences or disciplines that he sees as a field of action. The foregoing does not oblige to be aware of the technical means. The theoretical approaches overcome the simplicity of the methodological action traditionally used by the specialist in communications (Serrano, Piñuel, García and Arias, 1982).

The ‘communication in practice’ has preceded the ‘communication as a discipline’ and therefore the theoretical construction. This motivates to resume what Marcuse (1993) states about technological rationality; that is, in relation to the field of communication, in order to identify the epistemological source,

it will be necessary to deny all previous knowledge that theorized solely on the basis of the practical. The first studies referred to the transmission of messages, only from the technical side, leaving aside the cognizant subject and creator of meaning, cultural aspects, intersubjectivity, and social environment.

On the other hand, Serrano et al. (1982) reconsiders the need to start from personal communicative experiences, beyond the simple technological medium. The objective will no longer be the description of the event but the understanding of the phenomenon and its particularities. "For the theory" what is known "is not the limit, but the threshold of scientific knowledge. That limit is transferred through the methodical interrogation by the how, the why and the what of the communication. Such questions allow to acquire scientific aptitude" (Serrano et al., 1982, p.95).

In the same order of ideas Serrano et al. (1982) thinks the sender and receiver as actors (Alter and Ego) that, from a communicative attitude and expressive work, transform matter (organic and inorganic) into an expressive substance capable of linking both, generating understanding and understanding. Thus, the epistemic basis of communication is found in the basic interaction between actors who seek to understand and understand each other. This essence is subsequently transferred to the methodology of strategic communication as the ultimate goal in digital environments.

METHODOLOGY

Research Focus

From the perspective of Kuhn (2004) paradigms tend to be substituted, questioning the theoretical, axiological, methodological and epistemological validity. This implies presenting, in most cases, antagonistic positions that distort the previous proposals. In social research, the same thing happened at the beginning of the positivist (quantitative) paradigm as the ideal way to understand the social fabric. Years later, Max Weber himself questioned it and it was the beginning of the interpretative-comprehensive (qualitative) proposal.

In sum, both visions were revolutionary according to the particular digital contexts. Nowadays, it is clear that neither of them is capable of analyzing or understanding reality in its entirety or completely (Álvarez-Gayou, 2009). It is enough to review the research questions or the objectives to understand that social complexity requires a joint work, that is, a mixed approach.

Hernández et al (2006) suggests that the mixed approach allows collecting, analyzing and linking quantitative and qualitative data in the same study; which will allow responding to the approach of the problem. This is based on the triangulation of methods that facilitated the discussion and precise understanding of the phenomenon of interest. Thus, different levels of the object of study are approached holistically. Creswell (cited by Hernández et al, 2006) points out that mixed approaches "achieve a greater variety of perspectives of the problem: frequency, amplitude and magnitude (quantitative) and comprehension (qualitative)" (p.756).

Based on the variables and categories of the research, a research with a mixed approach is considered pertinent since, at the same time, it seeks to understand interpretative categories such as the communicative phenomenon; but it is also interesting to measure the degree of effectiveness in the flow of information inside and outside the organization. The mixed proposal will allow the project dimensions to be extended to the objective and subjective aspects simultaneously.

The actions to be carried out in the field application will be determined by the use of data collection techniques through interaction with the group to be studied.

Study

The present investigation is identified as an exploratory study, since “part of a state of knowledge in which we wish to examine a research issue or problem that has been little studied and proposes the possibility of carrying out a more complete investigation”. (Hernández, 2010).

Study Units

Taking into account that the worlds of art and culture are conceived as networks of collaboration, co-operation and participation as well as work are the means to generate and distribute both ideas, projects and products (Becker in Canclini and Urteaga, 2012). The classification of Olmos (2004) is retaken, in which it categorizes the selected groups as:

- a) Professionals: artists, creators, managers and professional cultural managers.
- b) Specialized experts: professionals specialized in cultural institutions, exchange between people of common experiences, tutorials and comparative analysis of artistic and public forms.
- c) In addition to responding to the following characteristics taken from the Neugovsen proposal (s.f.)
- d) The cultural organizations must propose a relevant activities in the cultural artistic field of the geographical areas indicated and be recognized by peers or by other organizations
- e) Have a clear entrepreneurial attitude in terms of perseverance, vision, mission, and sustainability.
- f) Belonging to any of the following categories: Plastic Arts, Performing Arts, Literature, Video Production, Music, Editorial, Cultural Diffusion, Public Formation

Once the indicators were established, the selection of the study units was made through a panel of experts (Hernández, 2006) and the cultural organizations were classified in the following three levels:

First level:

They have the presence of specialized experts (professionals specialized in cultural institutions, exchange between people of common experiences, tutorials and comparative analysis of artistic and public forms) is valid in the great majority of cultural organizations.

Second level:

The cultural organizations propose at least one relevant activity in the cultural artistic field in Puebla and Cholula, they show within their agendas the proposal of activities directly related and relevant to art and culture. This organizations produce: the conjunction of workshops, to production, promotion or financing in the form of cultural products and art pieces.

It is clear that among the main motives of cultural organizations, artistic creation is present as a means of social enrichment, beyond the merely economic level that a forum would represent.

Third level:

They do not have specialized experts to manage the exchange and professionalization. Both are institutions more focused on the distribution and promotion of friendly formats for cultural consumption, but do not have among their objectives the production of art (beyond serving as a forum).

Census

The units of analysis were the cultural organizations of San Andrés, San Pedro Cholula and Puebla. 21 units was studied, they were established by means of a census or also called complete enumeration, this is determined when it is possible to examine each person or element of the population that one wishes to describe in its entirety (Lenvin and Rubin, 2004).

The process to establish the universe was carried out in a period of one month, through primary sources, experts in the cultural field in Puebla were consulted.

Instrumentation

The collection of information was done through two instruments. For the qualitative stage, a semi-structured interview was built that was applied to the leaders of each organization while the quantitative phase was measured by means of a liker scale.

On the other hand, it considered a semi-structured interview guide, which was constructed under a sequence of themes corresponding to the strategic communication model of Massoni

The qualitative interview allows the opportunity to know the points of view of the participants in the research, about their worlds as they are described in their own words. It covers from an unstructured approach to a semi-structured one. It is used to reinforce the perspective around the strengths or weaknesses of the plans, programs and / or projects. Within its structure the questions respond to an order, but can be answered freely by the subjects (Mayán, 2001).

Once the interview guide was built, its validation process began. The judging stage consisted in subjecting it to review for its feedback to experts.

At the same time a questionnaire with a DEO scale was chosen because, as defined by Hernández (2010), it is a document that will record the data that can be observed and that will represent the concepts or variables that the researcher establishes.

In which the calculation of sub-indicator scores are made in the following way:

All the scales of the reagents of the DP001 - DEO - Questionnaire have contemplated response options that correspond to the rating scale, considering five options. Only in some cases is the response “did not answer” or “does not know”, when it is considered feasible and the non-response can be tolerated. An example of this scale and its values for a question can be:

The sub-indicator score is the equivalent to the score of each item in the questionnaire independently. It is calculated by the average of the scores obtained in that reagent, for the cases interviewed valid. In other terms:

Sub-indicator score $R_i = \sum (x_i * f_{ai}) / N-n$

Being:

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x = Value that the response options of each case take.

Criteria of x per case: Likert scale (1 to 5, x = 100 to 20)

fa = Absolute frequency of the values of x.

N = Total registered cases

n = Total of null cases, canceled, unanswered or missing value.

On the other hand, the calculation of each indicator score is equivalent to the average score of all sub-indicators that comprise it, for each of the cases. Since the indicator per case is not a questionnaire reagent, its value must be calculated first for each case, before being able to define the average score for all cases.

Once the indicator value has been calculated per case, the average score is calculated in the same way as for the sub-indicators. In other terms:

Indicator Score $IND_i = \sum (ppi * fai) / N - n$

Where $ppi = \sum x_{IND} / \sum RIND$

Being:

pp = Average value of Indicator for each case

fa = Absolute frequency of the values of pp.

N = Total registered cases

n = Total of null cases, canceled, unanswered or missing value.

x_{IND} = Value taken by the response options of each item that makes up the indicator.

Criteria of x per case: Likert scale (1 to 5, x = 100 to 20)

RIND = Each reagent that forms an indicator

A Cronbach's Alpha was also applied which resulted in a 0.92, which indicates that being between 0.81-1.00 has a very high degree of reliability (n = 65, Cronbach's Alpha = 0.95).

RESULTS

Project Team and Internal Communication

As part of an internal communication is in the activities that understand communication in a correct digital work environment and reduce potential barriers through personal knowledge and the consolidation of work teams.

The functioning of the organizations of the third level is clearly focused on the communication between them. The smaller or less formally structured, communication is a solid and indisputable tool.

Both the quality and the functioning of the communication within the organizations is a factor in which both the organizations of the first (52.5%) and the second level (65%) are in complete agreement, while for the third it is It is simply agreed (63%).

It is clear that there is a consideration towards internal communication, although they differ in the degrees of opinion the majority concentrates on totally and in agreement.

“We are linking everything: the material on the page, the online store, the reviews, Facebook, Instagram, tweeter, Tumblr, now notes on the cork to expand the field a bit more. Expand horizons not only sales but also diffusion and thus make more marked the presence of prophetic networks. “Prophetic (Organization of the first level).

80% of the second level organizations consider that the choice of channels for the members tends to be flexible, thus acting all in their function. For the first level this opinion is reflected in 60%, and finally with 45.5% in the third level, which is also found in the flexible results (36.4%).

It is difficult, in my experience when coming to another type of social dynamics, we publish in a magazine in Montreal and in the idea of emergency with a thing that in Oaxaca is called Tequio, it is a pre-Hispanic model of social organization to solve problems “The foundation of the text is the emerging practice becomes heroic and is considered new” Collective Bear. (Organization of the second level).

“A meeting a week are few, they coincide 3 to 5 hours a week. We triangulate information ... in order to move forward. We identify the importance of having clear processes, defining roles of positions, but when making the list of needs (communication, production, volunteers, management with industry) We know that 3 people are very few. “Imagoría. (Organization of the second level).

The choice of communication channels is an element that determines the formality. The professionalization determines the type of structure, therefore, it is seen that while the organizations of the first level, the answers in the maximum degree of flexibility also exist in the minor degree, the opinions are considered very rigid.

“Procedures that have to do with employees absolutely everything is in writing, increases in time, schedules, redistributions on schedules, responsibilities and absolutely all”. Written by Facebook we have a space for that type of management. “Arquetopia (Organization of the first level).

It stands out again, that most of the organizations of the levels are constituted by few people. Communication is a determining tool, communication information can become formal channels in the way it is used and the results obtained.

Apparently, the choice of communication channels. In this case, there is no completely dominant pattern.

“All the time we are in communication, the lines are always open, email, Facebook, cell phone and the phone in the office and we are always on Skype we are in communication with Oaxaca and Puebla. Everything is confidential always. “Archetypia. (Organization of the first level).

42% of organizations. Another 20% state that mainly formal means are used and another 20% answered that it is by informal ways.

The second level organizations consider that the use of formal channels (55%) is prioritized, and to a lesser extent a mixture of channels (25%) or frequently informal media (15%).

“It’s vital. Text messages generate problems. Learn to work with the other when working with people from different areas. The huge amount of information. The safety of team members greatly influences. The exercise of the bulletins began. 1 weekly: schedules, materials, birthdays, coordinators and meeting minutes. The base group is less formal ... Book sign: in the Facebook group book signal is set and everyone knows that it must be answered before midnight. “Comelibros. (Organization of the second level)

And the third level organizations consider that informal media are the most used mainly (36%).

“Digital media such as: WhatsApp, Facebook (fanpage), e-mail and videoconferences. Usually I send messages by Facebook Messenger, Skype or WhatsApp.”. Torpedo. (Organization of the third level).

The diversity of opinions on the preference to communicate within their organizations, demonstrates the diversity of thoughts, projects as well as structures. Denotes a freedom in their habits, times and goals to achieve objectives, in addition to the own dynamism of the cultural and artistic sector.

Project Team and External Communication

In general there is agreement that there are specific methods to ensure the effectiveness of external communication. The organizations of the second level reflect 50% of “totally agree”, while those of the first level 47.5%.

“We have evaluation system, for each project we have a format that is filled as the residence is advanced and there are taking notes of agreement work system.” Arquetopia. (Organization of the first level).

The organizations of the third level are only in agreement in greater proportion (45%), while those of the second level in 40% and the first in 22%.

“There is response from the people, there is the slope of the material that arrives, increase in followers in the networks, more interaction. There are people who are not interested in the event or do not know or do not know and there are people who do and it is their first time. Through the impact on networks and assistance is how we measure what we are doing right and wrong. In the sales area, as are the sales of the promotional material: auctions, editorial proposals is how we measure. “Prophetic. (Organization of the first level).

“When there is time what is done is to anticipate the information, as such there are no formal ways to verify. There are also annual evaluations that each coordinator verifies that his work team has the necessary information week after week. “Comelibros. (Organization of the second level).

There are no formal effectiveness measures. In some cases the systems to verify the information are focused on statistics such as the number of visitors to a web page, attendance at events and interaction in general on social networks.

“Several meters are used, including graphs that measure the reception that the bulletins have had in the different spaces where they are distributed, as well as the statistical package that Facebook provides to understand the circulation of information ...” Rizoma. Organization of the first level).

Speaking of the importance of external communication, basically everyone agrees that the performance of the organization depends on the effectiveness of external communication, invariably on the level of organization.

“From a comment with a reader or starting from the understanding that we are up to date, what happens in contemporary art publishers, every time something comes up nationally and internationally we try to incorporate it or at least put it on the table ... The project still moves under unofficial channels, “waiting for the right moment in the project to validate itself.” Torpedo. (Organization of the third level)

There are only more skeptical opinions in the third level organizations (18% say they agree partially)

The topic of external communication with the different actors of their professional work is similarly recognized in general by the members of the third level organizations. Relating and communicating is no longer a task that is only privileged, it recognizes the functioning inside, but also outside it.

Project Control

The organizations indicate the determinant that is what communicates abroad, both in information and content. Therefore, the methods of control that are used for this action to be fulfilled are important. It

can be seen that there is no specific formula. Once again the needs and resources of each organization are diverse.

“When there is time what is done is to anticipate the information, as such there are no formal ways to verify. There are also annual evaluations that each coordinator verifies that his team has the necessary information week after week.” Torpedo. (Organization of the third level).

“We have a program, which is a brainstorm but instead of ideas it has projects, with needs, requirements, how to solve things ... The maps that we make every six months are called compasses that have to be solved, what is pending and what is has to do to solve “Collective Bear. (Organization of the second level).

“No system as such, but they have weekly sessions to solve problems.” La Morada. (Organization of the second level).

CONCLUSION

Communication for teams in cultural projects, should observe the following issues:

First, assume that project teams in cultural organizations, by their very nature, are complex structures. Therefore, they must be studied from a theoretical proposal, which is a review that refers to the different types of communication.

Second, the digital channels and the levels in which the management is carried out inside and outside must also be taken into account. This will lead to the understanding of the processes that make up the structures that result in the construction of new elements of study.

Another aspect is oriented towards the construction of an operational model for controlling projects in digital environments, in which the information derived from local cultural production can be recorded systematically, which has a general impact on society.

Reinforce the development of messages and communicative actions that include the different members of the organization, regardless of the hierarchical level that exists between them, which will affect finding solutions for linking with other organizations in the same field.

Cultural organizations are leaders in the development of joint projects, with the support of communication tools in digital environments. To achieve this, it must clarify the objectives that generate cohesion at different levels and contexts.

Finally, participation is imperative, not only the members of the organization, but also the members of the community. This will reinforce the efficiency of the project teams, since it involves all the stakeholders, that is, it reinforces the participation of the organization as a whole. In addition, it will be a way to meet the objectives. “The strategic aspects of the project teams do not have to do with the level of the structure where it is coordinated, but with the integrated and the high impact and the benefit it causes for the organization (Pérez en Soria, 2008, p.14).

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Chapter 19

Principles of the Management of Projects Applied to the Development of Neighborhood Stores

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ABSTRACT

This chapter describes the specific characteristics of neighborhood stores; for this purpose, a brief summary of the historical conditions in which they have developed, their evolution, characteristics, and the conditions that make them different from other formats of retailer commerce is presented. Taking into account that this is a business model that raises from the base of the pyramid and is developed in the provision of services in a high percentage, it raises some basic concepts of this model that are applicable to the neighborhood store. On the other hand, the authors look forward to bring together the basic concepts of project management to the store from two perspectives, the first from programs that may or may not be from the government, that bring support in the search for its consolidation as a socially and economically sustainable model, and the second from the own management of the store, which due to the lack of fundamental knowledge on administration from the owner, seems to be condemned to its survival, without major possibilities of growth.

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INTRODUCTION

The neighborhood store has been considered one of the fundamental axes of retail commerce in different parts of the world, becoming the preferred channel for consumers and, as a consequence, one of the channels to be developed by the major brands of mass consumption products.

This importance has allowed the neighborhood store to remaining business in spite of the vertiginous progress that, at a global level, the large stores or hypermarkets have had, becoming large multinationals of the retail trade.

In this sense, it would be assumed that the store had a process of development and growth that would allow it to leave its own condition of store and take a step forward, with its consolidation as a mini-market or even as a supermarket. However, things are not like that, the store remains more like a subsistence business for the shopkeeper and his family, with limited growth possibilities, either due to the characteristics of the business or the conviction of the owners, who, in most cases handle it as a whole integrated with family finances, a fact that causes distortion in the own finances of the store.

Thus, it is clear that there are no business elements that are applied to the administration of the store, a fact that becomes one of the main obstacles to the management of the store.

Now, the possibilities of growth of the store multiply when there is management, when it is understood as a business project and, in this order of ideas, the adaptation and application of the Project Management methodology, with its basic concepts, can be the beginning of the path to go beyond the basic satisfaction of the needs of a family.

In this case, although it is not a project in the orthodox sense of the word, the assimilation of concepts such as planning, execution, and monitoring and control are clearly applicable to the development of the business. On the other hand, to the same extent that the owner of a store understands the scope of his own business, visualizes it with specific goals over time, determines the structure of costs and expenses that he has in his establishment, sets the level of quality of the products he distributes or sells, creates a purchasing model, identifies and communicates with his stakeholders, and knows the risks that he may incur in the management of his business, he can consolidate it and lay the foundations for its stable development and growth.

This chapter aims at describing the most important aspects that, from a project management view, should be part of projects aimed at improving the conditions in which neighborhood stores operate, and the particularities that must be taken into account in order to implement strategies of stabilization and growth of the same, attending the postulates of the management of projects. For this, in the first instance of the document, the history and the facts that favor its permanence in the retail market are analyzed; then, it establishes the classification of the different actors of the retail market, with special emphasis on the substantial differences that there are between them; subsequently, the basic conditions of the business model that is implemented by neighborhood stores are considered, to then describe the aspects that should be taken into account in the projects of accompaniment and business intervention in neighborhood stores, as well as those that are necessary to consider as a specific project whose objective is their permanence, development, and growth in the market; and finally, the conclusions of this work are presented.

BACKGROUND OF THE NEIGHBORHOOD STORE AS A BUSINESS MODEL

The neighborhood store is part of the history and culture of contemporary society, especially in Latin America, a region in which its permanence is still wide, being a fully consolidated business model, despite the adverse conditions it has experienced in the last 20 years. The shop, essentially, has been the place for the purchase of perishable and essential products, a function that has been developed since the foundation of the large urban centers (Triana, 1989; Páramo, 2012), where the need to collect and sell these products arose for a working class community that was grouped into small areas of land with a high population density.

Thus, the existence of a captive market was one of the facts that helped in the consolidation of this type of retail market, which in principle was assembled individually with a high degree of specialization that over time was lost. As a consequence of the growth of the urban center, the suppliers of different products were concentrated in just one place (market squares) and then, they adapt to the concept of a much more general neighborhood storekeeper, offering products of all kinds but closer to the client, regarded as a fundamental part for the supply of the products it distributes, in a neighborhood with a growing population (Tapias, 2005).

The marketing of the product, its presentation, or even the marketing strategies were concepts that were completely unknown for the neighborhood store and for the vast majority of its suppliers. It is only at the end of the 50s, that some of these concepts were incorporated, more by the brands that supplied the products than by the same shopkeeper, who, because of his position in front of the community, was almost unique supplier of the products his customers required.

The store is part of the retail market whose changes have been rapid since the 60s, with the emergence of the first supermarkets, then with the arrival of large hypermarket chains, and lately with the development of low-cost stores and the growing penetration of catalog and internet sales models that have already permeated the market for the products of the family basket.

This permanent change has taken place on the basis of the conservation of parameters that subsist over time and that has characterized the retail trade since its inception, one of them, the stable coexistence between the different market players, hypermarkets, supermarkets (in its different versions, neighborhood, chain, or superette), convenience and low cost stores, up to the smallest expression of the retail market represented in neighborhood stores, stationaries, sundry shops, pharmacies, and butchers, among others (Silva, 2012).

Faced with market conditions, it is convenient to establish a categorization of the different retail establishments, according to some of the characteristics with which they provide the service.

In recent years, the so-called low-cost stores have gained a presence. This new business model has received the name of “store” because of its proximity to the community; its growth has been vertiginous and has managed to penetrate the different socioeconomic levels of the population. These establishments are part of large chains with local presence, but with a national perspective, they are installed in areas that are comparable to or even smaller than neighborhood supermarkets, they offer a wide variety of products, but with a limited number of options to choose from regarding brands or sizes, the exhibition has elements that are similar to those of the neighborhood supermarket with the difference that there is unity of format in each and every one of the sale points.

Then comes chain supermarkets and hypermarkets, with similar areas, use of cutting-edge technology for the management of their inventory and the logistics of their operations, but with some differences between them. The first one, the format of the chain supermarket, in the process of disappearing, was

Table 1. Segmentation of retail stores by sales areas

	FORMAT	TECHNOLOGY	CASH REGISTER	AREA
Neighborhood store	Countertop	Very low	0	20 - 100 M2
Superette	Self-service	Low	1 – 2	50 - 100 M2
Neighborhood market	Self-service	Medium	3 – 4	200 M2 – 400 M2
Low cost stores	Self-service	High	2 - 4	200 M2 – 400 M2
Chain supermarket		High	More than 4	More than 400M2
Chain hypermarket	Self-service	High	More than 4	More than 400 M2

Source. Prepared by the author.

traditionally dedicated to sell essential goods in ample premises, comparable with the areas that nowadays hypermarkets have, but with the arrival of the latter, they have had to modify their format and look more like them, however, in the search to maintain their essence, providing consumer staples, they have also developed formats that are closer to neighborhood supermarkets and low-cost stores, with which they manage to remain in the niche markets that prefer to purchase in small establishments that meet the needs of the client in a more effective manner.

Hypermarkets are the most modern retail development, with a non-specialized format in which different categories of products are sold, in some cases even luxury goods. These establishments continue offering consumer staples, but they have a product portfolio in their sale points that includes technology, clothing, and even financial and entertainment products.

Despite the dynamics that were previously expressed, the Latin American market is characterized by the coexistence of all the aforementioned formats, which struggle to maintain or increase their market share, trying to exploit their strengths, even in the case of informal traders, with price and innovation in the way of offering and selling the products to the final consumer (Silva, 2012).

THE CUSTOMER OF THE NEIGHBORHOOD STORE: ITS GREAT STRENGTH

Although the client is a significant element in the development of any type of market, in the case of retail, he plays a significant role since it is thanks to his buying habits and consumption, the same economic dynamics that he manages, and the social conditions in which he operates, that it has become the determining factor for the continuity of the store in the conditions of competition that it must face.

In this sense, the conditions of clients in different Latin American countries are similar and respond to cultural and behavioral patterns that are typical of the region. D'Andrea and Lunardini (2005) state that, in the retail market, there are five types of clients that are properly characterized: (i) bid hunters whose main activity is the search for the lowest price, they constantly compare, loyalty to the establishment is not their priority, and they spend a lot of time shopping; (ii) high income bidders who make their analysis of offers among a smaller number of options, preferably in larger establishments with modern exhibition formats, without this determining a loyalty to a particular establishment; (iii) buyers who are frustrated by their low budget and whose purchasing power is lower than that of the previous group, they don't frequent large hypermarkets and supermarkets much, and limit their spending due to the impossibility of buying many of the products that are sold in those establishments, (iv) variety seekers with limited

budget who have a larger budget but limited by the composition of their families, like modern formats preferring to make larger purchases less frequently for which hypermarkets are their best alternative, and finally, (v) buyers who value quality and time, with greater purchasing power and better spending capacity and consumption, who prefer to pay more, not to worry about comparing prices, if this represents savings in time and convenience in the purchase.

Despite this classification, of general nature, the customer of the neighborhood store is differentiated by other conditions that are analyzed by Ramírez (2008). According to this author, the customer of the store is governed by 14 values: family, authority, tradition, hierarchy, obedience, economy (includes the price and size of the presentation or miniaturization as elements for decision-making), trust, collective sense, cordiality, gratitude, cleanliness and aesthetics, leisure, nutrition, and equality for women.

The study by Ramírez (2008) confirms several of the premises that are held in the behavior of the customer of the neighborhood store. Even with the social changes and the urbanization schemes of the cities, the store is a fundamental element in the daily life of the neighborhood; the store is synonymous with fresh products offered at an affordable price for customers, a fact that generates loyalty and gratitude of the client towards the shopkeeper, which are increased by the credit they grant and the terms that are adjusted to the reality of the cash flow of the client-debtor, which, depending on the request, can be daily, weekly, fortnightly, or even monthly.

For the customer, the shopkeeper is the social axis of the community. The customer identifies the shopkeeper as a cordial person who serves the entire family nucleus (including children), managing to generate trust, other than offering the products in presentations, in many occasions not offered by the brands, that meet the specific needs of the client, usually due to the financial impossibility of acquiring larger presentations.

The neighborhood store is still the smallest expression of establishment of the retail market, retaining several of the characteristics that make it a unique business model that is important in the daily economic habits of ordinary citizens (Acevedo, 2017). In the store, there is a shopkeeper who sells his products standing behind a counter and has access to most of the exhibition, which is on shelves and in a refrigerator that also works as the counter. The shopkeeper also has the possibility to suggest or decide on the purchase of his customer; the areas are small, usually part of a house, suitable to fulfill the function of store, in which tables and chairs are installed for the purpose of offering a place for the consumption of some foods and drinks that are sold in the same store.

On the other hand, the superette and the neighborhood supermarket must be differentiated from other types of establishments. The superette is the next phase to the neighborhood store, it is the consolidation and growth of the same, it is still a family business initiative, served by a person who is no longer behind a counter, but in a cash register, usually located at the entry/exit of the establishment, where the customer is charged for the products he purchased. It is the smallest manifestation of the retail market in the form of self-service, leaving the choice of the product and the size in the hands of the client who chooses it from a reduced portfolio of options that are exhibited in small gondolas that work as shelves. The superette only has one establishment, it is unique and is not part of a chain, therefore, it retains some of the characteristics of the store, as for example, the knowledge of the customer and the proximity to him, even when it no longer grants credit or offers food and beverages for consumption in the premises.

In the case of neighborhood supermarkets, there is a more entrepreneurial development of the store concept, fulfilling the same function yet seeking to serve a broader market, therefore losing some of the shopkeeper's own characteristics, such as the closeness and knowledge of the customer, the offer is much wider and the allocated area is considerably increased. Despite preserving its origin in the neighbor-

hood store, they have an owner who has grown hand in hand with his community, they have different points of sale, usually trying to cover a specific sector of the city, with a traditional exhibition scheme in which they combine shelves and the furniture of the exhibition of perishable products such as fruits and vegetables, which must be much more at the customer's hand since it is the customer who chooses size, quantities, and brands.

EMERGING CONSUMERS: A SPECIFIC NICHE FOR THE STORE

In a particular way, for the neighborhood store, the socio-economic situation of customers is of fundamental importance. Although, the neighborhood store exists in all the socio-economic levels, its greater presence is in the middle-low segments of the population; it is there where the size and the volumes of purchase give it greater preponderance, especially for two reasons: a) the capacity and frequency of purchase of the clients and b) the amounts of money that each client uses per visit.

In response to this, D'andrea, Goebel, and Stengel (2003) state the existence of a segment of customers which they refer to as "emerging consumers", composed of that fraction of low-middle income society whose consumption behavior is specific and favors the permanence of the store in the market since their consumption in products of first necessity can reach between 50% and 75% of the total of their income.

Emerging consumers, despite being considered poor, are an important source of purchase of products that are sold in stores, mainly because their income is not stable and when stable income is achieved, it is destined to satisfy the basic needs of the family group. Although, their ability to buy is limited, they are not in favor of buying the cheapest brands in the market, and they usually look for intermediate or leading brands since the precept that "what is cheap turns out to be expensive" is fulfilled in them. In this sense, it is a challenge for the shopkeeper to achieve a portfolio that is attractive for this segment while serving other potential customers with different needs.

These consumers are characterized by having a daily income, making it difficult for them to purchase products in large sizes, thus generating the habit of acquiring products in smaller sizes even if this means having a greater proportional expense. The former leads to the conclusion that it is the presentation and not the price what becomes one of the determining factors of the purchase, with which the proximity and savings in other expenses, such as transport, influence decisively. Despite the benefits of finding a wide variety of options for purchase, this consumer prefers to preserve the tradition and to be loyal to the brand, devotes very little time to the analysis of advantages and benefits that a product can bring compared to the one he consumes.

One of the most important features of this segment of customers is the fact that they are grouped in a great category that has been called "popular class", without major differentiation on the part of the big players, understood as a uniform body, a problem that is easily interpreted and assumed by the shopkeepers who, due to their size and limited area of influence, develop their business towards a more homogeneous consumer that is not affected by social and economic variables typical of large populations, and that responds to a more standardized behavior as a result of belonging to a subculture that is inherent in the neighborhood in which they live.

THE BASE OF THE PYRAMID: A SOCIAL FUNCTION TO COMPLY

It is pertinent to think that those parts of the population with lower levels of income, are groups whose consumption capacity is very small, a fact that is valid if we make an analysis from the individual, but not so much if it is considered that in an aggregated manner their power of purchase multiplies and with this, it acquires a significant importance for those companies whose objective is the manufacture and sale of products of massive consumption (Prahalad & Hammond, 2005). This fact has facilitated for the commercialization not only to look for the people with great purchasing power, but, as a fundamental part of the business development, it seeks to take care of the people that by definition compose the base of the pyramid, which as was warned, can generate high volumes of sales for companies, as long as the offer considers the specific needs and consumption behavior of this large portion of the population as important elements (Prahalad & Hart, 2002).

Although the large companies have improved their marketing schemes and have tried to reach different market niches, their large distributors have not managed to penetrate this segment of the population, not even with the low cost stores, created specifically to serve a population with lower purchasing power.

Thus, the neighborhood store continues to maintain its importance, to the same extent that they manage to settle all the problems of intermediation and approximation of the products to those markets.

Because of their social connotation, people living in poverty are not subject to large market strategies, on the contrary, it is considered that the costs that must be incurred in making a presence in this market can easily exceed the benefits to be obtained. However, Prahalad (2010) shows that business opportunities are open and that the base of the pyramid can become the great market that allows the growth and strengthening of companies that make the decision of taking a slice of that cake.

The identification of the purchasing potential of the base of the pyramid has brought about that companies from different sectors of the industry establish very clear guidelines regarding their relationship and presence in this market. Retail sales, basic needs of families, telecommunications, agriculture, and the financial sector are those who have taken the first step and are already part of the supply of products to this segment of the population. Others are exploring possibilities, education, health, wellness, and energy (Prahalad, 2010).

The above serves to demystify several of the assumptions related to the purchasing power and consumption habits of the base of the pyramid. The same companies have realized the possibilities that it offers, the investment of the equation that represents the profitability, reducing the margins but increasing the quantities that are sold, and the taste to consume products from more developed markets, which leads to the acquisition of products whose cost supposes a great economic effort for those who acquire them (an example of this is the use of mobile telephony). The belief that the base of the pyramid should be served only by social programs that are offered by governments and non-governmental organizations, discovering the enormous commercial potential that it contains, has been distorted.

Faced with the facts, it is important to highlight that those companies that have ventured into the base of the pyramid have been forced to make a judicious analysis of their cost structures and the intensive use of capital. On the other hand, the development of markets and the modernization of business processes have become a strong driver in the fight that has been declared against poverty in the world.

Despite the achievements of large companies, it is important to recognize that the process has only become successful to the same extent that alliances have been developed, most of them tacit, between micro-enterprises and large-scale stakeholders who are interested in selling products. This is where the traditional retail market, in this case the neighborhood store and other micro-establishments, serve as a

channel for the retail sale of products that are manufactured by these large companies, generating profits, not only in the distribution, but in the development of innovative market penetration strategies, adjusted to the reality of this population.

The large company has collected important information on how the store operates, has learned and has innovated in relation to products, presentations, packaging, and tastes of the base of the pyramid, developing products that are more consistent with the target audience, facilitating in this way the daily work of the shopkeeper, so that he can dedicate more time to the essential activities of his business, since some of the activities that he previously performed have been incorporated into the products, for example the miniaturization in the presentation of the products and the labeling, among others.

A PARTICULAR BUSINESS MODEL

According to Osterwalder and Pigneur (2010), a business model describes the unique combination of the different resources and activities that are articulated for the creation of a company or organization, and the way they complement each other to generate value. In this sense, Chesbrough and Rosenbloom (2002) relate this generation of value to processes of innovation and Morris, Schindehutte, and Allen (2005) consider that the factors that help in the consolidation of the business are intimately linked with the relationships that can be built with the different interest groups (Osterwalder, 2004).

In line with the above, Cervilla and Puente (2013), define a business model as the set of decision variables that allow an organization to create competitive advantages taking the operational, tactical, and strategic conditions as a reference, as well as the environment of the organization in order to attend to the environment in which it operates.

Cervilla and Puente (2010) have characterized the business models that emerge from the base of the pyramid and that serve the base of the pyramid, concluding that these ventures: (i) arise from the need resulting from unemployment or from the insufficiency of resources for meeting the basic needs of the family group; (ii) they are business ideas that are developed with a low level of risk; (iii) they are business ideas that are developed by entrepreneurs with a low level of education; (iv) these entrepreneurs see entrepreneurship as a form of economic independence; (v) they try to supply the necessities of a quality of life that is suitable for them; (vi) they try to hire as less employees as possible; (vii) they develop entrepreneurship around the place where they live, which gives them a sense of security and protection; (viii) they do not look for more training because they consider it unnecessary; and (ix) they have a low level of innovation since they consider that what they have and the market, the base of the pyramid, are enough, since they do not require anything else.

In agreement with the above and from what is expressed by Morris *et al.* (2005), the neighborhood store has particularities that make its business model to be specific and unique, which does not prevent the neighborhood store to be a clear example of the precepts above. In spite of this, the business model of the store responds to the characteristics that are presented in table 2:

The neighborhood store is a business model that, with very few exceptions, does not go beyond the first generation. It is an instrument that serves so that this first generation builds the social climbing bases of future generations. Since it is a business in which the principle of management is closer to subsistence than to growth, it is important to establish that the store, for the most part, is in the second of five business phases according to Churchill and Lewis (1984), for whom a company can exist, survive, succeed, be in a position to start growth, or in full maturity.

Table 2. Characteristics of the business model of the neighborhood store

1. Value proposition	Offering mass consumer products close to the customer and with competitive prices and quality.
2. Customers	Neighbors of the area of influence, inhabitants of the neighborhood.
3. Internal capacities and processes	Low level of specialization, low level of business knowledge in the initial stage of entrepreneurship, internal processes with low level of development.
4. Positioning / Strategy	Closeness, friendliness, store assortment.
5. Income model	Daily sales.
6. Evolution, ambitions, and growth expectations.	As an exception, what is sought is the growth of the store, which is given more by the reception of the clients and the growth of demand; in a few occasions, it obeys to an intentional action of the entrepreneur/businessman.

Source. Prepared by the author based on Morris *et al.* (2005)

PROJECT MANAGEMENT: A BROAD VISION FOR THE CREATION AND DEVELOPMENT OF BUSINESS STRENGTHENING PROJECTS IN NEIGHBORHOOD STORES

In this section, we will consider two ways to approach project management and the importance of its precepts for the development of neighborhood stores. In the first instance, we will propose the necessary elements to develop a project to accompany neighborhood stores, and in the second instance, we will explain how those same precepts can be used in a timely manner in a neighborhood store, without this implying being part of a macro project, understanding for this, that a project is carried out in order to achieve an objective within an organization, whether it intends to develop a product, create a service, impact on an entire organization, or on a part of it (Project Management Institute, 2017).

ACCOMPANYING PROJECTS TO SUPPORT NEIGHBORHOOD STORES: A NECESSITY OF THE SECTOR

Regarding the management models that are applicable to one or another business initiative, many of them develop in an integral manner the needs of each sector or group of companies in which their application is sought, the natural consequence of this is the particularization of the models, attending the specific situations of each group, defining applicable aspects in the day-to-day management, and in its strategic development.

Most of the intervention projects in the neighborhood stores have been initiated taking the entrepreneurship or models that favor the maintenance and development of the store as a fundamental axis; however, the projects have suffered, mostly, from a previous preparation that allows the execution of a series of joint tasks that, in an integrated manner, allow fulfilling its objective. Therefore, we can consider valid to appropriate and adjust management models to be applied in accompanying projects or organizational intervention to business initiatives or consolidation of some businesses, to the same extent that they respond to the solution of problems or the attention to situations that are typical of their normal proceedings.

In accordance with the above, the appropriation of the concepts that are used in project management can serve as a reference in the development of a project that aims to develop favorable conditions for the creation and growth of this type of establishment.

Because of its strategic importance in the supply of basic goods, especially to segments of society with low-income levels, the support to neighborhood stores is a task that can and should be implemented by various entities, both governmental and non-governmental. There is no denying that there are support projects, which, due to the volume and the impossibility of performing close monitoring, have had very specific results, specifically in some geographic sectors chosen to do the intervention.

Neighborhood stores are not a consistent entity; on the contrary, they can have as many variables as there are stores, and appear or disappear with a frequency that is not typical of other business models. These facts mean that any project that wants to be implemented must be solidly thought out, in such a way that it can reach the end with impacts that merit the effort that was made.

In this sense, the management of projects that is presented as a technique that allows the application of practices, principles, processes, tools, and management strategies in the development of a job (Project Management Institute, 2017), contains precepts that, if well applied, can help in the development of a deep and lasting process of mass intervention in stores.

Although, the management of projects has been the central axis of the execution of diverse macro projects throughout history and around the world, its postulates can serve as a guide for the development of smaller projects since they contain management guidelines that favor the normal development of a business activity.

The execution of a single, specific project, does not bring the required impacts; in order to achieve the objectives with neighborhood stores, the project must have continuity and, accordingly, it is important to develop from the beginning a series of projects that, in an articulated manner, manage to change the perception of the shopkeeper in relation to their business model, perhaps one of the most difficult items to achieve since the shopkeeper does not conceive the store as a life project, but, in the vast majority of the cases, as a way to generate the necessary income to undertake the expenses of the family, and not necessarily developing a strategy of reinvestment and business growth.

Due to all the above, projects that seek to create sustainability and growth mechanisms for neighborhood stores must be very particular, must take into account the conditions that differentiate it from other business models, and must manage strategies and times accordingly.

To begin with, the direction of a project of accompaniment and organizational intervention requires the presence of a person who knows in detail the phenomena surrounding the operation of a store and the connotation that it has for the community in which it is immersed, a condition that is not enough; in addition, it is required to have solid knowledge of business management in the direction of the project, this mixture allows to understand the store in its true dimension, with the characteristics listed above, which does not allow for the postulates of the management, finance, marketing, logistics, or technology to be applied orthodoxly, but on the contrary, they must be fully contextualized to the particular phenomenon of stores. In this specific case, it is not enough to have the qualities and skills of the leader raised in the Project Management Book (2017).

With a visible head and knowledge of the particularities of the project, it is necessary to define the scope, in this sense, with the current situation of the store, the scope and projects that can be developed are different. The importance of the store in the societies in which it is present is fully evidenced, and its way of operating has been sufficiently studied, but beyond that, little progress has been made in

generating solutions to address its problems. Specific projects been developed only from the production companies, more in order to generate loyalty than a development and long-term growth.

The scope of the project can only be determined from a clear and deep knowledge of the characteristics of the store, the necessities of the store and the shopkeeper vary from one to another, the formulas can not be general, on the contrary, they must be individual for specific groups of shopkeepers, they depend on the different variables that surround the store, such as the geographical sector, the income level of the population it serves, the age of the store, the age of the shopkeeper, etc. and of the specific needs. Depending on the development of a store, it may have deeper needs in aspects related to finances, one of the most repeated problems, the exhibition, the purchasing processes, or any of the areas of management of the shopkeeper.

Therefore, it is important to have a basic diagnosis in which the conditions of the store and its environment are evident so that they can be classified and, thus, provide shopkeepers with tailored solutions that are much more appropriate for their particular situation, without it being inconvenient for them to be included in development programs in areas other than management.

The particularities of the sector mean that the times to develop projects have a high level of uncertainty, to the same extent that one must have the consent and active participation of a large group of shopkeepers who want to be part of the project, therefore, it is necessary to establish rational times that allow the fulfillment of the tasks that have been designed, avoiding that, due to the own difficulties in each one of the phases of the project, delays may incur.

Fieldwork is an activity that requires great efforts and resources, once the scope of the project has been defined, a thorough analysis of the time that is required for the gathering of the information must be made. It is necessary to take into account that the stores are establishments whose density in a specific area varies depending on the geographical area and the communities it serves, in this sense, it should be particularized and set differential compliance goals depending on the conditions of the group of stores to visit and diagnose. This has an important impact on the amount of resources that must be available.

The development of a communication scheme with which the different actors can be made aware of the importance of a project of these characteristics is a key factor. The greater the amount of information, without this one being redundant and uncomfortable, the greater the probability of participation. Despite its recognized importance, communication is not taken into account within the strategic activities of a project, in the particular case of those who seek to improve the business conditions of a shopkeeper, this acquires significance to the same extent in that obtaining the shopkeeper's conviction and his empathy with the project are key factors in its success. The shopkeeper is an entrepreneur whose level of academic development is low, on average; therefore, using clear and forceful messages is a good way to achieve their participation.

With regard to the monitoring of the progress of the project, there are no particularities beyond those stated above. The setting of the milestones of the project with their respective scopes and objectives must be clear and measurable.

The measurement of the results can not be done at the end of the project, in fact, a project can not be finished without having the following one defined; it is a consecutive series of projects that collect the previous ones and set new challenges. The results in the stores are seen over time, it can not be expected that the stability of this business model, in an aggregate way, is evidenced in the short term; its development and growth takes a while and its success depends on the accompaniment that it has during its development.

One of the main risks that is assumed in the development of a project of accompaniment and intervention in stores is related to the attitude of the shopkeeper towards his own training. For different reasons, among which we can state the apparent lack of time, the impossibility of leaving the store for activities other than catering, or the belief that training and accompaniment are not a true added value for their exercise as a shopkeeper, the projects may fail. These situations must be planned in such a way that the active, conscious, and determined participation of the shopkeeper is achieved with the aim of seeing his business grow.

THE NEIGHBORHOOD STORE: BUSINESS UNIT OBJECT OF MANAGEMENT

As it has already been shown, project management, in addition to serving as the axis for the development of activities aimed at the execution of large projects, can contribute to smaller projects, such as the development of the store. For this, it is absolutely necessary for the shopkeeper to be the central axis of the project, for him to be the one who directs the start-up of the different activities of the growth project, and sets goals and deadlines that are adjusted to his business reality, that is to say, for the shopkeeper to become the director of the project.

No one better than the shopkeeper knows the reality of his business unit, however, it is not normal that he has the ability to classify and structure the information in such a way that it becomes the necessary input to perform a proper diagnosis; for this, it is important for the shopkeeper to count with the accompaniment of an expert who guides him in this task, who helps him in the classification of information, in the establishment of strengths and weaknesses, and in the identification of opportunities and threats.

With this consideration, the shopkeeper must be aware of the importance of his development project and the fulfillment of the different milestones that must be met. Due to the size of the organization and the possibility of implementing changes in an accelerated way without requiring concepts or approvals prior to making decisions, the project should not be developed in very long but rather short periods of time; all the activities should be developed in a few months.

In addition to being the director, the shopkeeper becomes the executor of the project of his store, this implies that one of the aspects to take care of is the time that is allocated to the project in a specific way, clearly differentiating the hours that are destined to the normal course of the store from those that must necessarily be assigned. In order to achieve success in the development of tasks, it is convenient to accompany the shopkeeper in the first moments of this phase or create for him the necessity to leave the workplace and, in a different environment, be able to perform his tasks and do the follow-up to the objectives that have been projected.

In spite of constituting itself as a very small business unit, it is necessary for the general project to be disaggregated into different smaller projects, responding to the specific needs of the store, achieving the final synergy in the scope of each one of the parts of the large project. In this sense, it is pertinent to develop projects for each of the functional areas of a company, giving the opportunity to the shopkeeper to identify small achievements, to dedicate himself to few tasks at once, instead of taking responsibility for understanding different aspects of his business simultaneously.

The results of any project that is implemented in a store can be seen in the short term, actions taken by the owner are developed very quickly and their impacts are evidenced and evaluated by the same owner, even when they are affecting several functions of the store.

But that facility in action and evaluation is also one of the latent risks that may exist in the implementation of the methodology. Given the total autonomy that one can count on, we can skip intermediate validation processes that allow, in advance, foreseeing possible consequences of one or the other decision. In this same line, the project must be developed in phases, looking for the shopkeeper to consolidate knowledge, develop habits, and firmly believe in the benefits that the implementation of an 'improvement project' has for his establishment.

CONCLUSION

The neighborhood store has been established as an element of the culture of several Latin American countries, a fact that is leveraged in the social and economic conditions in which the society develops in this part of the world. As a consequence, this situation has brought for the neighborhood store to be considered an essential part of the culture and for that importance to be still maintained in the supply of products of first necessity. Its role in the economy is still significant, despite the arrival of other players in the market, many of them with a very large financial power, a fact that has questioned the continuity of the store.

The conditions in which it opens up, its contribution to the development of specific communities, and the factors that make it different have created a competitive advantage for the store that in turn has taken advantage of, so far without making it possible to state that its future is guaranteed.

In the current social conditions of the countries that have them, the stores cannot disappear. Their disappearance can have serious consequences for the economy of those countries in which they manage a good percentage of the retail market, not only the supply of goods to the families that demand them is important, so is the large number of families that depend on them for their daily sustenance.

For the neighborhood store to continue to be maintained, it is necessary to generate programs that include support projects, mainly in those aspects in which the shopkeeper is weak and does not manifest clear intentions of overcoming his deficiencies; this being one of the great problems that can be found in the development of general intervention projects in the neighborhood store sector.

However, projects can not continue to develop in the same way, they must articulate with each other, they must be complementary, develop skills in the shopkeeper that allow his future sustainability, that can read the conditions of his environment and implement the changes that are necessary for him to be adapted to it.

Between the strategy of support and intervention to stores and the specific projects of each business unit there are significant differences when comparing the time that the results take, while in the first case the results take long time to become evident, in the second one the results can be very fast; the intervention can bring benefits that if they are evident for the shopkeeper to facilitate the development of future projects of greater magnitude.

In this order of ideas, it is important to accept the methodology that is suggested by the project management so that the interventions that are carried out are of real impact that last, that provide the information and necessary tools to the sector of the shopkeepers, in such a way that their business continue to maintain the importance for the community, despite the attacks that they may receive on the part of other market players who see in the customers of the shopkeepers a niche to attack.

ACKNOWLEDGMENT

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Chapter 20

Universidad EAN Breaking a Babel Tower Applying SAP as a Tool Under a PMO Model

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ABSTRACT

This chapter describes the PMO model used to renovates the information systems of the Universidad EAN that before 2015 operated with multiple obsolete tools, generating incidents in the management of the information required for its operation. As part of the institutional innovation project implemented to ensure economic and administrative efficiency besides its strategic alignment, a SAP-based solution was implemented allowing it to move from a technological babel tower with almost 40 independent information systems in multiple platforms, towards a comprehensive platform that ensured a unified interoperability model with a scalable hardware infrastructure, using state-of-the-art applications supporting the provision of self-services to the community, expanding IT capabilities, reducing the risks, increasing the information security, improving the quality of service, and, despite being it in a stabilization stage, has been supporting the operation in an efficient and effective way, as shows the institutional results from the financial and academic quality perspectives.

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BACKGROUND

Institutional Data

History

According to institutional documents (EAN, 2018), operations began as the Escuela de Administración de Negocios – EAN on August 10, 1967, with an Associate Degree in Business Management. Subsequently, on October 11, 1968, Hildebrando Perico Afanador, Cecilia Crissien de Perico, Carlos Ramírez Cardona, Álvaro Rubio Salas, and Carlos Alfonso Crissien Aldana signed its founding charter and after almost 40 years of success and in recognition of the relevance of the academic processes developed, the Ministry of National Education recognizes it as a University through Resolution No. 2470 of May 30, 2006.

Currently and as a result of the excellence of the processes associated with the institutional substantive functions of teaching, research and extension, it has managed to position itself to promote sustainable entrepreneurship, considering leadership and innovation as fundamental elements in the generation of abundance for humanity, being one of the few Higher Education Institutions in the country to obtain the High Quality Institutional Accreditation, recognition that it has held since 2013 and that was already renewed by the Ministry of National Education through Resolution No. 29499 of December 29, 2017, reflecting the institutional vocation to maintain the highest quality standards for the development of its substantive functions.

Aware of the need for self-improvement, the Universidad EAN has undergone international scrutiny of important accreditation systems, among which it is worth mentioning the ABET that, fulfilling the demanding conditions for the teaching of Engineering in the United States of North America, accredited the Production Engineering Bachelor Degree in 2012 and renewed it in September 2018. Another relevant accreditation is that conferred by the ACBSP, also in the United States of America, in the area of knowledge of Management Sciences, who after of an exhaustive review of the degrees in that area of knowledge, they certified them in their entirety since 2008, renewing them in 2018. In this same area of knowledge, but in the field of public accounting, in the United Kingdom, the ACCA certified the Universidad EAN in 2017 to train accountants with the highest international standards. In the perspective of the higher institutional purpose related to sustainable entrepreneurship, in September 2018, the ACEEU certified the Universidad EAN as an institution with a clear orientation towards entrepreneurship. This interest is not only restricted to the academic sphere, but also to the support areas that have achieved ISO 9001 certification for more than a decade with the associated periodic updates.

After more than half a century of activity and sustainable growth in all aspects, including physical and technological infrastructure, as well as a healthy financial behavior, several improvement opportunities were identified that required attention and especially in relation the information management for the decision-making process exploited through a project whose management is describe below.

Situation 2015

With the change of the Chancellor in November 2014, a deep revision of the structure of the Universidad EAN was developed, which would respond to the need to stop the deterioration of the financial margin that had taken place during the previous years as a result of a growth model that modified the institutional financial balance (Advantis - BOT, 2017) and that included key milestones such as the recognition as

University in 2006, the obtaining of the High Quality Institutional Accreditation conferred by the Ministry of National Education in 2013 and the international accreditations of various degrees in the area of Management Sciences by ACBSP in 2008 and the Bachelor in Production Engineering by ABET in 2012, with a redirection of the academic proposal from a focus on management with an emphasis on entrepreneurship towards an University with a variety of degrees in different areas of knowledge, in addition to the certification of all the processes in ISO 9001 since 2008.

The policies of academic, management and financial operation of the Universidad EAN had allowed a sustained growth of the income until the first semester of 2014, in the high rank of the peer Universities, sustained in the increase of new students as a result of the extension of portfolio and the significant increase in the tuition fees, however, by that time it was already intuited that in the short term it would not be possible to maintain this positive dynamic because the trend of the base of national aspirants was decreasing and the macroeconomic contraction indicated that it would not be possible to continue increasing the tuition fees in a significant way in such a way that it would remain attractive as a result of institutional positioning. On the other hand, the policy of expanding the portfolio with new degrees had not generated the expected impact, with high variability in the results of enrollment and financial performance of a significant part of that portfolio below expectations with more spending than income, despite the changes in the structure of costs and expenses that did not compensate for the effort, explained mainly by the progressive change of the mix of professors towards higher-profile teachers with remunerations above the market average, as a necessary condition for obtaining the described achievements, all of which clearly indicated the need to review the growth approach of the Universidad EAN to ensure its sustainability in the economic dimension (Advantis - BOT, 2017).

After a careful analysis developed with the support of experts, it was concluded that the Universidad EAN should intervene integrally through the so-called Project 2020 in order to ensure economic and administrative efficiency, as well as strategic management aligned with the expectations of academic quality through 15 initiatives classified according to their impact on 10 efficiency initiatives, 3 strategic initiatives, and 2 transversal initiatives; one of them aimed at technologically supporting all the processes and that was in charge of the Financial and Logistics Vice-Chancellery with direct responsibility at the head of the Information and Communications Technology and Innovation Management.

The Information and Communications Technology and Innovation Management made a diagnosis of the institutional situation in relation to technological support and documented a large number of incidents related to the management of the information required for the operation and for decision-making that will ensure sustainability in a highly changing and turbulent environment such as that associated with the Higher Education Sector, which required a process of evolution of the educational model that would accommodate the trends imposed by the fourth industrial revolution (Cardona D., 2018). He also documented the high level of technological obsolescence of the University and the low levels of automation that generated cost overruns for the alternative schemes required to support the operation.

Selection of the Solution

Project Management

Institutionally, it was decided to intervene at the Universidad EAN with a team of coordinated internal Project for technology issues from the Information and Communications Technology and Innovation Management through a model of “Project Management Office - PMO” that allowed efficient use of

resources available through the establishment of protocols, documentation and metrics that centralized their implementation (Midler, C., 2019).

Despite the fact that the institutional conditions associated with the operation generated a series of restrictions for the allocation of the resources required for implementation, the PMO model allowed to overcome these restrictions, also counting on the commitment of the senior management and being clear that a PMO will not necessarily ensure the success of the Project, given that it is not a tool of universal application as stated by different authors (Giraudo & Monaldi, 2015; Large, 2018; Muñoz & Sanz, S.F.; Hernández, 2016; Cardona & Peña, 2013).

The PMO model used at the Universidad EAN had a double profile, on the one hand, of support; to provide stakeholders with objective, structured and comparable information in a homogeneous way, allowing them to understand and apply it with greater efficiency in relation to the investment of resources and progress towards the proposed results. The PMO allowed the senior management team of the Universidad EAN to know in real time the status of the Project, the degree of compliance with the objectives, the use of the assigned resources and the level of compliance with the schedule.

On the other hand, the model used in PMO allowed, with the compiled information, courses of action that guaranteed the adjustment of the Project to standards and indicators established collaboratively with all stakeholders as a reference with a certain degree of flexibility that allowed respond in real time to detected deviations through defined channels of communication.

Search

Need

The Project team, based on the diagnosis made, raised the need to carry out a technological renovation of core systems that support critical processes, including academic, financial management and human development with the objective of achieving integrated information systems, safe and robust with a unified interoperability model supported in a scalable hardware infrastructure through new models that allow to operate next-generation applications through self-services directed to the community and the use of analytical information schemes (Montañez, 2017).

Improvement Opportunities

The proposed renovation sought to solve at least the following improvement opportunities documented by perspective:

- Technique: heterogeneity of technologies, obsolescence in products, absence of an interoperability model, incidents in information security.
- Operative: distributed information, low level of automation, quality of information, reprocesses.
- ICT Government: no clear business allies, multiple service models, absence of a product roadmap.
- Strategic: difficulties in meeting challenges and needs, inconsistencies in decision support tools.

Documented improvement opportunities generated risk at the time due to the loss of information with low quality and integrity, the result of the use of unauthorized software on highly vulnerable platforms

with low availability of IT services that generate loss of opportunities, regulatory noncompliance (SNIES, habeas data) and in general weak IT support for the strategy.

As previously indicated, technologically and strategically it was expected to achieve integrated, scalable, safe and robust information systems, in addition to moving from a technological babel tower with almost 40 independent Information Systems in multiple platforms to a reduced number of information systems under one same technology that will ensure a unified interoperability model with a scalable hardware infrastructure through new models, using state-of-the-art applications supporting the provision of self-service to the community, expanding IT capabilities, reducing risks, increasing security of the information and increasing the quality of service.

Analysis

The Project team (Montañez, 2017), after the diagnosis made and the analysis of the sector, identified possible products to build the proposal requirements that were sent to the identified suppliers. After the proposals were received, a careful evaluation was made, the procurement was carried out and the implementation was started.

In the analysis of the sector, the situation of 22 institutions was reviewed, which 4 were visited, including meetings with academic networks such as RUMBO and RENATA and the IT services model of the Whitney Network was reviewed, which allowed to identify as options, integrated solutions of recognized prestige among Oracle with PeopleSoft; SAP with SLCM, Ellucian with Banner and OCU with Universitas XXI.

An evaluation process was carried out taking into account the following criteria:

- Manufacturer backup
- Scalability
- Level of specialization in higher education
- Integrality of the solution
- Change costs
- Level of technological dependence of the provider
- Level of impact on processes and organizational culture

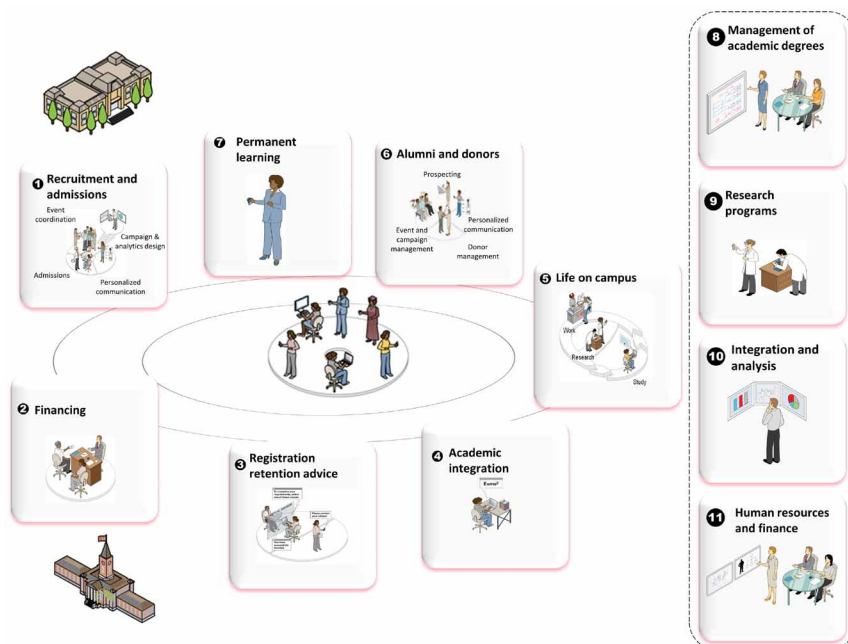
Ideal Solution

The Project team (Montañez, 2017) proposed an ideal solution that covers at least the 11 aspects as described at Figure 1.

- Recruitment and admissions
 - Reduction in selection and admission time
 - Management of large amounts of information on prospects and applicants
 - Centralized visualization of student information
 - Measurement of the effectiveness of recruitment campaigns
 - Increase in the conversion rates of admitted prospects.
- Financing
 - Knowledge of the status of income in real time

Figure 1. Ideal solution

Source: Information and Communications Technology and Innovation Management



- Reduction in operating costs and improvement in the service
- Reduction in time in student recruiting by having an online payment processing tool
- Reduction in processing time for the generation of student finance reports
- Control of the financial aspects generated by student mobility.
- Registration retention advice
 - Online information for the government entities
 - Automatic monitoring of the academic quality of the student
 - Consultation and programming of classes and student's academic record
 - Predictive identification of students, with emphasis on students at risk.
- Academic integration
 - Reduction in time for manual tasks and information reprocessing
 - Reduction in operating costs and improvement in the service by consolidating operations in a single application
 - Savings in the use of resources involved in the academic planning process.
- Life on campus
 - Improvement in data integrity through a single source of student information
 - Reduction in up to 80% of face-to-face transactions
 - Improvement in the service to students through the "Single window of services"
 - Student-centered service scheme that increases service levels.
- Alumni and donors
 - Increase in donations through the coordination of activities for alumni and sponsors

- Increase in donations through the identification of prospects and support for cross-referencing opportunities.
- Permanent learning
 - Creating valuable relationships with the university community
 - Promotion of the contribution of the university community through the formation of relationships for life
 - Obtaining additional resources for the institution.
- Management of academic degrees
 - Reduction in time and complexity in the creation or modification of the academic offer
 - Facilitate and control student mobility
 - Flexibility of the academic offer.
- Research programs
 - Increase in resources associated with research programs and their results
 - Integration of Universidad EAN with a productive environment.
- Integration and analysis
 - Visibility and knowledge about the performance of the Universidad EAN, processes, and students through KPI monitoring
 - Identification and adoption of best practices
 - Alignment of strategy and execution in all functions
 - Increase the value of existing data and applications.
- Human resources and finance
 - Reduction of time in human resources and finance processes
 - Teacher training
 - Management by results (goals and objectives) of the teachers and management staff
 - Reliability and security of financial and management information
 - Savings due to the consolidation of purchases.

Solution Chosen

After the analysis, the Universidad EAN decided to implement an integrated solution based on SAP, with the support of an Expert Company in the implementation of Projects based on this solution, which would allow managing the processes associated with the substantive functions; financial and academic enrollment, class programming, registration of subjects, among others, and which would allow the support processes to be managed; accounting, human resources, among others.

The components acquired were:

- Vertical SLCM of Educational Services
- ERP Financial, Accounting and Logistics component
- ERP component HCM for Payroll
- Business Object for the generation of Reports and Presentation of Information
- BPC for consolidation of Financial Statements and Budget Projections
- Success Factor for the implementation of Human Management processes
- C4C component to cover Marketing and Customer Service functionalities.

It must be borne in mind that each of these components has functional and technical modules that impact more than one process in the Universidad EAN and that respond to the requirements delivered and their go live strategy will be aligned with the institutional academic and administrative calendar.

In agreement between the Universidad EAN and the Expert Company, intervention in the following processes was included in the scope of the Project:

- Generate Accounting
- Treasury Management
- Fixed Asset Management
- Analytical Accounting
- Budget Development and Control
- Materials Management, Suppliers, Purchases, and Inventories.
- Sale Store, Consulting and other sales.
- Financial Registration
- Human Management and Payroll
- Customer Relationship Management
- Management of the Student Life Cycle (Academic Processes)
- Financial Planning and consolidation.

Likewise, by common agreement, the scope was identified from the perspective of requirements on the Education Vertical and on S/4HANA with the other components.

From the perspective of infrastructure, exclusive hiring in a modality of hosting and services of delegated management was decided, that included the data center, hardware, software, communications and the support services and management of the SAP Solution. As part of the IT strategy, an integration bus was hired to send and receive information between the different components of the SAP.

On the other hand, as expected in an implementation project like this one, the impact is in the technological tools and in the way the processes are carried out, therefore, an Expert Company in Change Management was hired to support the definition of the organizational structure of the Project team, including the selection of its members and the incorporation plan, alienating the executive committee with a shared vision to which it wishes to reach and coordinating the initial training activities required for adaptation to the work dynamics within the Project. It was also expected to identify the factors in favor and against the change to define short and medium-term actions as an input to the change strategy that involved, among other actions, the definition of the communications strategy by identifying the gaps between current and future processes to mitigate the identified impacts that would be generated during the deployment phase, without forgetting that it is necessary to act in the expectations management, where it is critical that the incidents presented are dealt with in a timely manner and the end user feels the support of the Project team, with a strategy of support for performance and a communicational campaign executed optimally.

Finally, given that an Organizational Transformation Project of the complexity developed by the Universidad EAN demands a real accompaniment from the first stages of structuring and planning, going through its formalization, contracting, execution and closure. This is why an Expert Company was hired to follow up on the Project to ensure the main points that must be aligned with the challenges involved in executing a Project to implement an ERP, including the review, negotiation, and legalization of contracts

associated with the project. Project and revision of Project Management Plans, Risk Management, Scope Management, Documentation, Cost Management, Change Management, and control.

TECHNOLOGICAL IMPLEMENTATION

Methodology

As previously described, the Project was implemented with the Coordination Team for technology issues in the Information and Communications Technology Innovation and Development Management through a “Project Management Office - PMO” model. Available resources through the establishment of protocols, documentation, and metrics that centralized their implementation.

From the technological perspective, a SAP recommended methodology was adopted (SAP, S.F.) including 5 phases guiding de Project Managers, professionals and users through the required implementation tasks, offering tools and documents templates in order to guide the project deployment.

Project Preparation

In this first phase, the topics, schedules, resources assigned to the Project, communication scheme, monitoring, and logistics were reviewed and detailed. The deliverable was the navigation chart of the approved Project. In addition, the Leaders are included.

Business Blue Print – BBP

In this phase, the processes were analyzed and defined; Incorporating best practices, analyzing the gaps and personalizing the process while preserving its efficiency. Likewise, in this stage, the development machine was technically installed and configured. The deliverable was the document called “Business Blue Print - BBP” with the identified business models.

Realization

In this phase, the system was parameterized in such a way that it was reflected in the previously defined business models; the Leaders with the support of the consultants did the basic and integral tests of the system; with the configuration documentation, end-user manuals and the transfer of knowledge to the stakeholders; training in the end user and the preparation of data. In addition, in this stage, the machine for the production was installed and the strategies of printing, security and backup and accompaniment in the go live phase of the system were defined.

Final Preparation

In this phase, the end users were trained by the Functional Leaders; it is loaded into the master data and installed in the help desk to support the end users for output in production.

Go Live Support

In this last phase, the consultants accompanied the output in production until the first monthly closing.

Critical Success Factors

Controlling the factors defined below, mitigates the risks inherent in Projects involving an organizational transformation (Montañez, 2017).

Scope Definition

It is fundamental to define the scope of the Project with the implementer before signing the contract and initiating the Project. The probability of success was increased given that it was defined in terms of processes to be implemented and functional requirements. Given that the University had its processes defined and documented, a careful review was necessary in light of the implementation of SAP in the search for the redefinition of an efficient business model that supports corporate strategies, aligned with best practices.

Work Plan

It was necessary to review the work plan of personnel with knowledge of the ASAP methodology, with a clear Project scope and knowledge of the restrictions of the Universidad EAN as a condition for signing the contract.

IT Maturity Level

Thanks to the diagnosis made by the Information and Communications Technology and Innovation Management, it was clear the level of maturity of the IT area determining the new functions that this area would have to assume to ensure the sustainability of the system.

Work Team

As an integral part of the process, a work team with a high degree of commitment from Senior Management and Leaders was assigned for the development of the Project, with extensive knowledge of the processes to be digitized, with knowledge of all the areas and processes involved and with access to management levels that could scale incidents that occurred. This allocation of resources from the functional areas involved the hiring of personnel to cover their functions during the execution of the Project.

Data Migration

From the beginning of the Project, Universidad EAN worked on a strategy to migrate the data to the new system, with a team responsible for this issue that built a migration plan that mitigated the effects of this critical activity.

Change Management

Aware of the effects on multiple institutional fronts, work was carried out to achieve an adequate knowledge transfer to the Project team of the Universidad EAN in such a way that the adoption of the change was facilitated and the impact on the users of the new solution was mitigated.

Project Management Model

As previously described, the Project had a management model with a work plan that included deliverables consistent with those established in the different Project documents, verifying its relationship with the institutional academic and administrative calendar of the Universidad EAN and with other plans of related work under a PERT/CPM standard allowing to control the critical routes identified (PMI, 2019).

Structure

Fronts

To execute and control the Project, as well as to keep the different definitions integrated in the modules to be implemented, the fronts described at Figure 2 were formed:

Government Model

The above defined fronts obeyed to a government model presented at Figure 3 (Montañez, 2017).

Project Team

The Universidad EAN (Montañez, 2017) assigned a Project team made up of officials who knew very well the processes and the institutional business model, with an integrating vision and with recognition by the members of the process they represented, with teamwork skills and collaborative schemes. focus on achievement, which allowed meeting the expected times and quality, with a willingness to change, adapting new operating models and effective and assertive communication skills that had clearly defined functions according to their role.

In the case of Universidad EAN (Montañez, 2017), the functions of the following roles were defined:

- Project Sponsor
- Project Manager
- Front Leader
- Functional Leader
- Infrastructure Leader
- Data Leader
- Change Management Leader
- Process Leader
- Project Management Office

Figure 2. Fronts
Source: Information and Communications Technology and Innovation Management

Cross-Sectional Fronts	Project Management				
	Project Office				
	Process Front				
	Change Management				
Technical Fronts	Financial accounting (GL) Cost accounting (CO) Budget (FM) Treasury (TR), accounts payable (AP) Accounts payable (AR), invoicing (SD) Fixed assets (AM) BPC: budget planning	Purchases and Inventory G. (EN) Maintenance (PM) Projects (PS)	Payroll (PY) Personnel management (PA) Management of the organization (OM) Time management and assistance (PT) Success Factor (SF)	SLCM: STRUCTURE, Calendar, Academic Programming, Student File, Admission, Validations, Academic enrollment, Regulation, Billing, Scholarships and grants qualification, and attendance, progression index, Academic Advisory, Audit of degrees and graduation, graduates	Business Object (BO) CRM: Marketing campaigns
	Finances	Logistic	Human Management	Academic Management	Strategic Management
	Data				
	Security, roles and profiles				
Technical Fronts	Integration with other systems				
	Infrastructure, SAP management				

Figure 3. Government model
Source: Information and Communications Technology and Innovation Management

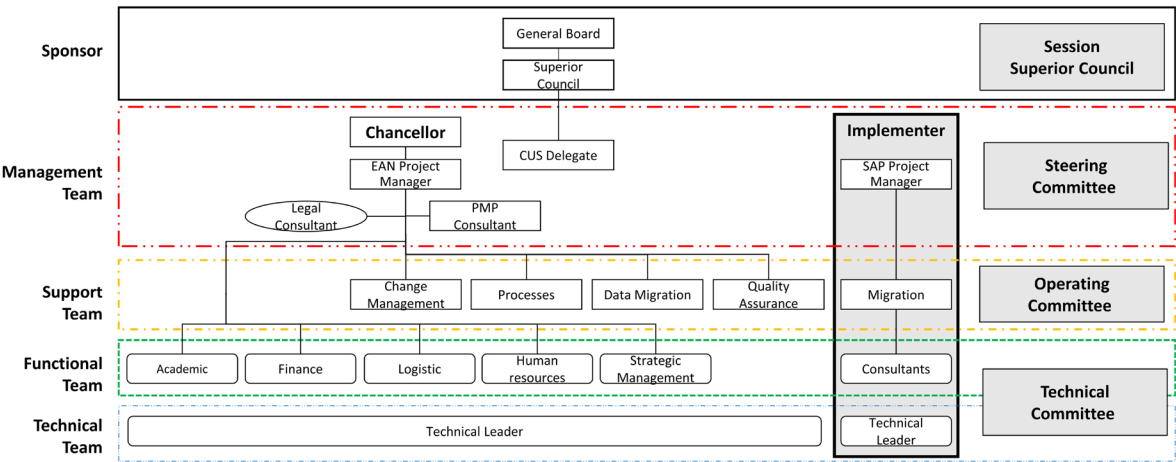
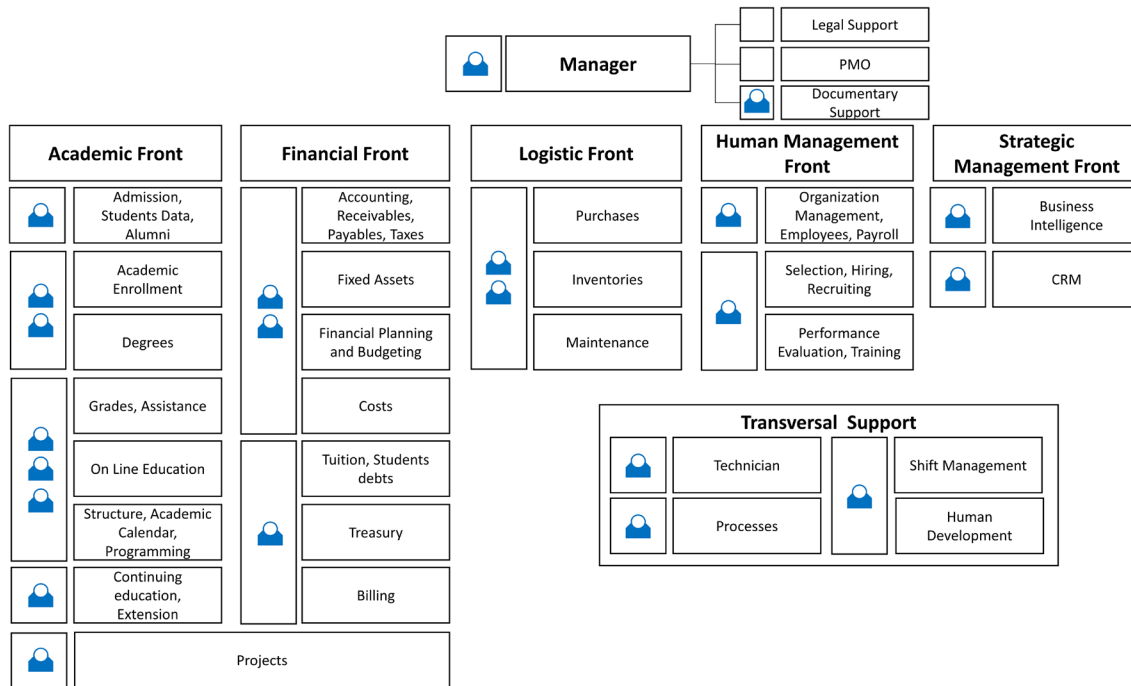


Figure 4. Project team

Source: Information and Communications Technology and Innovation Management



For the Expert Companies that accompanied the process, the functions of the following roles were defined:

- Project Manager
- Functional Consultant

Management Plans

Government Plan

The Universidad EAN (Montañez, 2017) defined control and follow-up structure through the following committees that ensured the fulfillment of the Project's objectives in terms of time, scope and cost, as well as the management of the risks and incidents that were presented in its execution.

Session Superior Council (Monthly)

- High-Level Presentation - Project Status.

Steering Committee (Monthly)

- Prior to the Superior Council
- Review of the status of scope, time, cost and risk management
- Follow up Commitments
- Validation of deliverables

- Critical cases
 - Change controls.
- Operating Committee (Weekly)
- (Project Manager - support staff - Implementer)
 - Weekly Meeting
 - Follow up.
- Technical Committee (According to schedule)
- (Project Manager - Technical Leader - Implementer)
 - Technical scope review - data - support.

In accordance with the execution of similar Projects and the requirements of Universidad EAN, additional Operational Committees were established to deal with specific fronts and activities that included:

- Change Management Committee
- Technical Committee
- Data Committee
- Committee for the Control of Changes to the Project

Likewise, weekly follow-up meetings were held to review the schedule, report on activities in development, identify risks and follow-up on commitments, with the participation of the Project Manager, the PMO Leader, the Front Leaders, functionalists and analysts according to topics, accompanied by the Project Manager of the Expert Company and the functional consultants according to topics.

It was defined that the meetings should follow detailed planning, prior citations via email with at least one working day in advance specifying the date, time, duration, place of the meeting, agenda and objectives. To achieve effective meetings, it was necessary to take into account that the number of participants should be limited exclusively to those necessary to meet the objectives of the meeting, since exceeding the number of participants caused distractions, inefficiency in the organization and non-compliance of issues. Keys according to confidentiality, should be initiated and finalized punctually. At the beginning of the meetings, the agenda items were clarified, reviewing the previous commitments and their progress. During the meeting, the cell phones were in silent mode and in case of answering it was done outside the meeting. Every meeting that sought a decision was accompanied by a minute prepared by the convener containing the decisions and commitments, the description of the item, the information of the person in charge and the date. The approval of the minutes was done digitally. If there was no communication of non-conformity or proposal of modification, the document was considered automatically accepted, remaining in its final version.

In this Government Plan and supported by the theory of Value-Earned Management (PMI, 2019; APM, 2013; SAP, 2017), characteristic of project management that integrates the indicators that reflect the scope, cost, and schedule of the Project at the activity level, the following indicators were used.

Quality Plan

In the quality plan, the quality standards and procedures for the Project and its deliverables were established in such a way that it could be confirmed that the Project met the defined requirements. In these terms, the control milestones for the performance of quality assurance activities were established, the

Table 1. Indicators (Montañez, 2017)

Term	Description
Time in values	The difference between what was expected to be with respect to the schedule of activities (time) and where the Project actually goes to a cut-off date
Variation in costs	The difference between what is expected to be spent and what has actually been spent on a project cut-off date
Cost Performance Index / Time	The relationship between the Time Performance Index (reflects the scope or not of the Project's programming expectations) and the Cost Performance Index (reflects the fulfillment of cost expectations)
Variation to Complete	Difference between what was budgeted and what is really estimated or will be spent
Completed progress	Expected Advance Indicator vs Actual Advance, this were extracted from the Project indicator, which is adjusted according to functionality and defined a date.
Variation	It allows, in terms of time, to establish in a short time the Project has moved away from the baseline. Functionality of the Project

activities that were carried out as part of the quality assurance of the Project and its duration were defined, with the deliverables for each milestone and the verification procedures quality.

The quality standards defined for the process were proposed from the ASAP perspective in the SAP Code Inspector tool in such a way that there was evidence of the use of the best SAP practices (SAP, 2008). On the other hand, quality standards were defined for the following deliverables:

- BBP
- Module configuration
- Test Script
- Customization Specifications
- Customizations
- Cutting plan
- Role configuration
- Comprehensive tests
- Volume tests
- Infrastructure.

Additionally, the following quality procedures were established:

- Formal closure of the deliverables through the signature of the minutes of acceptance of the same, even when exceptions are noted in the acceptance
- Integrated change management, for any modification to the Navigation Chart, closed BBPs and closed specifications
- Review of BBP in pairs, that is to say, that a consultant of the same discipline makes the review for the case of TR and AM
- Review of ABAP code and component names using the SAP code inspection transaction. The result is included in the technical documentation
- Verification of test scripts: verification of completeness with respect to BBP and specifications
- Verification of the cutting plan: Delivery of accelerators with minimum data and process activities.

On the other hand, for each quality review the following deliverables were defined:

- Technical Documentation of the developments
- SAP reports
- Report of results provided by the stress test tool.

Risk Management Plan

The purpose of risk management was to specify, through a risk matrix, the procedure to be followed for its identification and subsequent management of the mitigation/contingency plans.

In this exercise to define the risk management plan, the following terminology was agreed:

- Risk: Event, condition or future circumstance with a degree of probability of occurrence that can impact the development of the Project, and therefore the achievement of the proposed objectives. The risk comes both from threats to be identified and from faults when taking advantage of possible opportunities.
- Issue: It is the materialization of a risk, or in other words, a future event that became a reality and that impacted the development of the Project.
- Probability of occurrence: A risk, being an event that has not yet occurred, has a degree of uncertainty associated with its nature that corresponds to the probability of occurrence.
- Probability of impact: Corresponds to the consequences that risk may bring to the development of the Project, compliance with the objectives that gave rise to the Project or in the expectations of the groups of interest associated with the Project.
- Criticism: Indicates how important risk is for the Project itself in order to determine the degree of scaling and treatment to be carried out. The more critical a risk is for the Project, the Senior Management of the Project must be involved and the support of the Project sponsor may even be needed. Criticality is determined by the direct multiplication between the probability of occurrence and the impact.
- Contingency plan: Actions associated with mitigating the impact when a risk materializes. These contingency plans are designed when the probability of an impact is medium or higher.
- Mitigation plan: Actions associated with reducing the probability of occurrence of a risk. These mitigation plans are designed when the probability of occurrence is medium or higher.
- Remediation plan: These are actions taken when a risk materialized.

The key thing is that it was necessary to manage the risks that are inherent in the projects because they played the Universidad EAN in all its aspects deeply and structurally, therefore, must be detected and controlled to increase the likelihood of obtaining defined results in terms of scope, terms, and costs. In the previous terms, it was decided institutionally to hire an Expert Company in this field.

The risk matrix used in the Project consigned the risk identification date, the classification according to planning risks, methodology and approach, availability of resources, Project scope, functional, integration, data, infrastructure, change management, front where identified and the specific module, a detailed description, the probability of impact and occurrence and a state as if detected in the process, with delays, controlled, discarded, materialized, or assumed, and a brief description of the action plan

with a probability of occurrence and post-treatment impact classified as high, medium or low, the identification of a responsible person, a proposed and actual closing date.

The monitoring of the execution of the action plan before the mitigation of identified risks was the responsibility of the Project Managers and the PMO, with a weekly report of the status of progress of the treatment plan defined through a map of graphic risks that, with the risk matrix, reflected the status of the identified risks.

Together with the Expert Company, the following procedure for risk management was defined (Montañez, 2017):

1. Plan the risk management: Activities through which the risk management of the Project is planned and was under the responsibility of the PMO and the Project Management
2. Identify risks: Activities that allow identifying and detecting the risks that may affect the normal development of the project and the responsibility of all the members Project
3. Record introduced risk: in order to facilitate its management, control, and monitoring, all risks that are related to the risk matrix and the responsibility of the PMO and a specific participant
4. Carry out a qualitative analysis: the evaluation of risks. It includes the qualification of the relative probability of occurrence and the possible impact that would generate and be under the responsibility of the PMO and a specific participant
5. Plan response: Develop and plan actions aimed at reducing the impact or probability of occurrence and responsibility of the PMO, Project Management and a specific participant
6. Monitor and control: monitor the risks, evaluate the progress of the response plans implemented and constantly measuring their level of criticality. and was under the responsibility of the PMO and a specific participant

Scope Management Plan

The scope management plan has as main objective to define procedures and tools that are used to manage the scope of the SAP Implementation project in the Universidad EAN by identifying the documents that define the scope of the Project, the definition of a structure of decomposition of the work, the establishment of the procedures, the fulfillment of the requirements, the elements of delivery, the complementary elements of the project and the definition of the procedure for the control of changes.

In this exercise to define the scope management plan, the following terminology was agreed (Montañez, 2017):

- Scope: Activities necessary to comply with the requirements and expectations of the Universidad EAN in the development of the SAP Implementation Project
- WBS: Structure that contains the work packages to control and execute during the Project. It allows and facilitates the estimation of times and the allocation of resources
- Phase: Stages defined in the ASAP methodology of the SAP tool manufacturer, used for implementation
- Deliverables: Products or services received by the Universidad EAN
- Project: A set of interrelated and coordinated activities for the implementation of SAP, through which the adaptation, installation and start-up of the technology solution are carried out in an

integrated information system that automates the processes of Support for Strategic purposes, Financial and Human Management

- Scope management: Activities including the planning and monitoring of the activities and those involved in the Project, generating an acceptance and deliverables of the Project, controlling the scope as the performance of the scope of the Project and the associated product.

The verification of the scope consisted in the requirements management included in the Technical Proposal and in the clarifications presented in the contracting phase, its incorporation and evolution in the different stages of the Project, which was done using a Requirements Traceability Matrix. Likewise, the scope verification was completed with the acceptance of the deliverables of the Project.

One of the main aspects that makes it difficult to measure the success of the Projects lies in the lack of agreement at the moment of accepting the products of the life cycle of the deliverable. In order to optimize acceptance times and activities, the following procedure for acceptance of deliverables was defined jointly with the Expert Company as an expression of compliance with the scope:

1. Prepare the list of deliverables: At the beginning of each stage, the Project Manager, based on the WBS defined for each Phase, prepared a list of deliverables indicating the date of commitment
2. Propose acceptance criteria: The Functional Leaders in agreement with the Consultant defined concrete, measurable, verifiable aspects that allowed to establish the level of compliance with the acceptance requirements
3. Approve the acceptance criteria: Front Line Leaders and Project Managers were responsible for the approval of the defined Acceptance Criteria
4. Elaborate the deliverable: Those responsible for the deliverable develop the necessary actions so that the deliverable meets the defined criteria
5. Send the deliverable for approval: The responsible persons forwarded the deliverable to the interested parties; consultant and the Project Manager, Front Leader and Functional Leader
6. Forwarding to key users for validation: The Functional Leaders, once the deliverable was received, with the approval certificates sent to the key users to validate compliance with the acceptance criteria and the content defined for the deliverable
7. Collect acceptance signatures. Functional Leaders collected the signature of the Project Managers
8. Send to the PMO: The Functional Leaders delivered the document and the certificate of acceptance of deliverables with the respective signatures for their filing at the Universidad EAN, in accordance with the Documentary Management policies.

Cost Management Plan

The main objective of the cost management plan was to establish the levels of attributions, approvals, and delegations related to the budget, scope and time of the SAP Implementation Project at the Universidad EAN, complementing the responsibilities and main functions associated with the costs of each of the bodies and roles of the Project to support the execution of the different management plans of the Project in relation to the decision-making and scaling model.

Taking into account the need to keep the costs of the Project under control, the following budget control procedure was defined jointly with the Expert Company as an expression of compliance with the scope (Montañez, 2017):

1. Deliver approved budget: At the beginning of the Project, the sponsor from Universidad EAN delivered the approved budget to the Project Manager for its control and execution
2. Identify Project cost data: Monthly the Project Manager downloaded the costs charged to the Project
3. Review budget vs. execution: Monthly the Project Manager compared the budget delivered by the sponsor with the costs and expenses of the same to inform the steering committee
4. Present execution: On a monthly basis, the Project Manager prepared a presentation on the budgetary execution of the Project, warning of deviations from the project
5. Perform budget addition: At the time it was necessary, the sponsor with prior authorization of the committee was responsible for making additions in the information system.

It should be noted that the Universidad EAN took as a guide for invoice payments, specific events taking into account the estimated billing dates according to the fulfillment of the deliverables of the last Work Plan approved by the Steering Committee.

Communication Plan

The main objective of the communication plan was to establish actions in each of the Project phases of the messages identified as critical for the Project's stakeholders, specifying the periodicity and type of action to be developed. The actions included periodic bulletins with standard information, regressive counts for important milestones, messages related to important dates associated with the institutional academic and administrative calendar, pieces to communicate key achievements, speakers for offices, activity monitoring reports, training invitations, note of institutional press, pieces associated with the plan of reincorporation of officials assigned to the Project to their standards roles.

Support Plans

Document Management

The main objective of the document management plan was to define the procedures for the management and control of the general and technical documentation of the SAP Implementation Project at the Universidad EAN, which applied for all the documents generated during the execution of the Project in its different stages, and for the different work fronts (Montañez, 2017):

To this goal, a file nomenclature was designed that incorporated 6 components:

1. Name of the Project
2. Front of the Project or Module
3. Project Phase
4. Type of Document
5. Name Document
6. Version

The organization of the documentation was carried out using the document management tool of the Universidad EAN in Google Drive with specific folders according to the WBS defined and with the specific assignment of access permits.

Change of Scope Management

The goal of the scope change management plan was to establish a mechanism to analyze, communicate, validate, approve and monitor requests for changes in the scope of the Project that involve or affect resources, deliverables, time, costs or budgets (Montañez, 2017).

It was understood in the Project that a request for change was a request to change the scope, variations in costs or deliverables defined and approved in advance for each phase of the Project that could be generated by the Project Managers.

For the management of changes, roles, responsibilities, and activities were defined to support the identification and follow-up of the different change requests made, likewise established communication channels for the validation and approval of these requests. An application resulting from the following situations was considered viable:

- New business definitions: When the reality of the business changed or required to expand the scope of the Project to cover elements not contemplated
- Tests: During the tests, it was detected on several occasions that the reality of the business was different from that identified at the design stage, so it was necessary to adjust the designs to represent the reality of the business
- Output in production: During the start-up, it was detected on several occasions that the reality of the business was different from that identified in the BBP phase, so it was necessary to adjust the designs to represent the reality of the business
- Risks or issue: To mitigate risk or execute an action plan to remedy matters of interest.

Taking into account the need to keep the Project under control, the following exchange control procedure was defined within reach with the Expert Company:

1. Identify possible change to the scope; Anyone within the Project team was able to identify functional needs that were probably not included in the RFP or different Project documents and was obliged to inform the Functional Leader and Front Leader so that they could carry out the respective evaluation. of the requirement
2. Evaluate if the requirement is a change of scope; Once the requirement was escalated to the Leaders, it was checked against the RFP requirement matrix of the selection process and documents defining the scope. If within these documents the requirement was not contemplated, this was definitely a control of change within the scope of the Project. However, before making the respective request, it was also necessary to evaluate if said requirement was indispensable for the business and if there was any option that would meet the requirement
3. Fill in the application form; If the requirement was indispensable, the Leaders completed the change control format and sent it to the Project Management for consideration
4. Estimate the scope change; Once the completed change control format was received, the Project Manager of the implementer together with the functional consultants proposed a solution to the request and made an estimate in time and cost that was sent to the Project Management for evaluation and presentation to the Directive Committee
5. Present to the steering committee; The Project Manager of the Universidad EAN, if he agreed with the requested change, presented the steering committee stating the need and the costs associated

with the requirement mentioned, in order to obtain approval. The steering committee could decide, Approve, Adjust or Reject it

6. Record the status of the application. The Project Manager recorded the change request, its description, cost, associated time for its preparation and status in the matrix of exchange controls
7. Plan the change; If the change was approved, the contractor presented the detailed schedule for the elaboration of the requirement to the Project Management
8. Execute the change; Once the change implementation schedule was approved, the contractor committed to implement the change in the agreed times.

Team Management

The objective of the team management plan was to define the procedure for making changes of persons (resources) during the execution of all phases of the Project, for which the following procedure was defined jointly with the Expert Company (Montañez, 2017):

1. Request change of resource: The interested Project Management identified the need and requested it through the defined format. If the replacement is due to force majeure and it was not possible to wait for the defined days, the Management of the EAN Project could approve it temporarily so that it can be integrated into the equipment as required, while proceeding with the formal procedure described
2. Select candidate: The Project Management interested identified and selected the resumes
3. Submit candidate: The Project Management interested, presented to the Management of the EAN Project the candidates' resumes to be evaluated according to the defined criteria
4. Approve candidate: The Management of the EAN Project, after evaluation according to the established criteria, approves or rejects the candidate
5. Induce the elected: Project Managers began the process of induction and socialization with the Project and the necessary requirements were managed for their location in the workplace and entry into the Project headquarters.

Any change could only be made by a profile and experience similar or superior to the one it will replace and with the approval of the Universidad EAN that reserved the right to adjust the evaluation scheme based on the needs and characteristics of the replaced positions.

Data Migration

The objective of the data migration plan was to define the procedure to load into the system, the required institutional information found in the previous tools, for which a controlled migration by intervention fronts was agreed as follows.

IMPACTS

Quantitative

Bearing in mind that the objective of the Project was to ensure economic and administrative efficiency, as well as strategic management aligned with the regulatory requirements of high academic quality, the pragmatism of efficiency indicates that the best way to show the impact generated is through of financial results shown at Figure 5.

There is a trend towards improvement in financial results starting in 2015, which can be explained, even partially, by the optimization of the operation obtained thanks to the interoperability and unification in a scalable hardware infrastructure that increased the security of the information and increased the quality of service, result of the implementation of an integrated solution based on SAP using a PMO Model to develop the Project.

Second, from the perspective of regulatory alignment, the best way to show the impact generated is through the results obtained in the following accreditation processes.

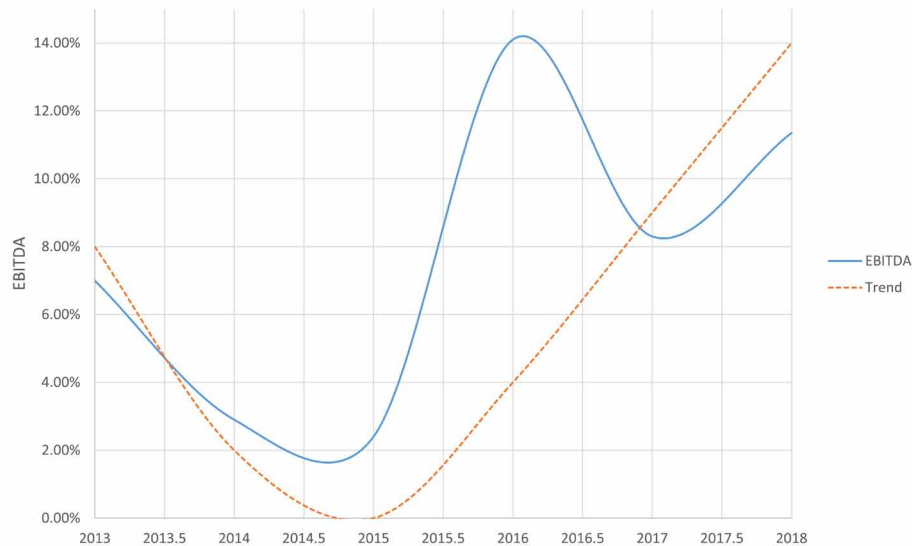
In spite of the optimization in the allocation of financial resources for the development of the substantive functions of the Universidad EAN, it is observed that the conditions of academic quality have been maintained, even with a tendency towards improvement, as can be sensed by obtaining new inter-

Table 2. Data migration plan (Montañez, 2017)

Front	Module	
Finances	GL	Financial accounting
	CO	Cost accounting
	FM	Budget
	TR	Treasury
	AP	Debts to pay
	AR	Accounts receivable
	SD	Billing
	AM	Fixed assets
	BPC	Budget planning
Logistic	MM	Purchases and inventories
	PM	Maintenance
	PS	Projects
Human Management	PY	Roster
	PA	Administration staff
	OM	Organization management
	PT	Time management and assistance
	SF	Performance
Academic Management	SLCM	Student cycle
Strategic Management	BO	Business
	CRM	Marketing

Figure 5. EBIDTA behavior and statistical trend

Source: Financial Planning Coordination - Financial and Logistics Vice-Chancellery - Universidad EAN



national accreditations. As of 2015, it is possible to explain, even partially, by the generation of a single platform for accessing the information associated with the operation, as a result of the implementation of an integrated solution based on SAP using a PMO Model to develop the Project.

Finally, associated with this perspective of regulatory alignment and related to one of the initiatives implemented to optimize the time allocated for the development of the Substantive Function of research, the best way to show the impact generated is through the results obtained in the periodic categorization calls of COLCIENCIAS, shown at Figure 6.

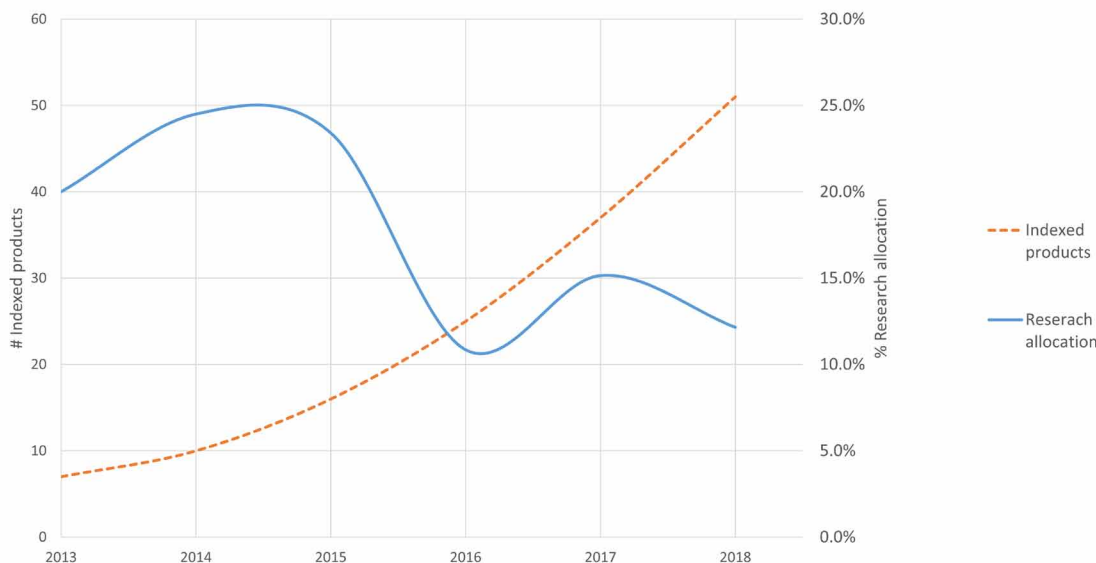
Despite the reduction in the allocation of research time in the Work Plan, there is a tendency to improve the levels of high-impact institutional productivity as of 2015, which can be explained, even

Table 3. Accreditations obtained

Entity	Beneficiary	Level	Type	Date
CNA	High Institutional Quality	Domestic	Renewal	December 29, 2017
CNA	Degrees	Domestic	Initial or Renewal	All the degrees presented have obtained it
ACBSP	Management Sciences Degrees	International	Renewal	April 20, 2018
ABET	Engineering	International	Renewal	August 27, 2018
ACCA	Accounting Degrees	International	Initial	February 7, 2017 (On Line) November 15, 2018 (On Line)
UBI Global	University Incubator	International	Initial	February, 2018
ACEEU	Entrepreneurship	International	Initial	September, 2018
ISO	Institutional	Domestic	Renewal	August 9, 2018

Figure 6. Indexed production VS Research allocation

Source: Research Department - Academic Vice-Chancellery- Universidad EAN



partially, by the existence of integrated, scalable, safe and robust information systems, as a result of the implementation of an integrated solution based on SAP using a PMO Model to develop the Project.

Qualitative

End users and members of the project team consulted, describe the impact of the project as follows:

...the key factors of the project success include the human team, the project structuration, the proposed management and government model, the support of experts in the sector - manufacturer and implementer, the definition of work teams and the third-party experts in change management, quality assurance, migration and data quality, legal counsel, and expectation management... [sic] ~ Rubén Gómez (Chancellor 2014-2018)

...despite being it in an expected stabilization stage, the effect of the implementation of the project can be considered as a best practice to be replicated as a Project Management Model in other Higher Education Institutions... [sic] ~ Diego Cardona (Academic Vice-Chancellor 2015-2019)

... the SAP Project has been successful, due to the support from top management, as well as its planning, the 100% dedication of the leaders chosen with deep knowledge of the University and its processes, with timelines and methodology follow-up, with accompaniment of full-time SAP consultants... [sic] ~ Luz Anaya (Staff Administration Coordinator, Human Development Management)

From my personal perception I think it was an excellent project, which has allowed us to integrate activities, be aligned with the same goal, and be aware of the goodness and good practices that the system has, a strong job for all collaborators to overcome resistance to change, to learn new things and put them into practice. Although at first they were not easy, today I consider that they are part of our day to day life [sic] ~ Diana Pinilla (Extension and Social Projection Coordinator, Academic Vice-Chancellery)

All new technologies implementation and changes in general within an organization require a very large process which is tied to the financial efforts of people, infrastructure, but most important, the people know and believe that the made are for the growth of everybody and the benefits that are going to have. This implementation was done in a very short time, but with the advantage that the people who worked on the project knew their processes and did it in a way always looking for the best for the organization... [sic] ~ Sandra Pulido (Acquisitions Technical Assistant, Financial and Logistics Vice-Chancellery)

As can be seen, the impact generated due to the PMO Model used for the implementation of an integrated solution based on SAP, measured with the financial, academic quality and research institutional indicators, and the impact perceived by the final users and the project team, can be considered highly satisfactory. On the other hand, the PMO Model allowed the optimization of the assigned resources and the level of schedule compliance.

FUTURE AND EMERGING TRENDS

A promising area for future research would be to further explore the quantitative impact measured via the financial results of the University and its behavior at the high quality measurements developed by third parties, including national and international organizations. On the other hand, to explore the qualitative impact measured via the affected organizational climate as a result of the multiples changes and uncertainty produced by the implementation of the SAP solution, focused mainly in the process adaptation, where the project has been essentially a vehicle of improvement.

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KEY TERMS AND DEFINITIONS

ABAP: Stands for Advanced Business Application Programming, formerly Allgemeiner Berichts-Aufbereitungs-Prozessor, is a high-level programming language created by SAP.

ABET: Formerly the Accreditation Board for Engineering and Technology, Inc., is a non-governmental organization that accredits post-secondary education programs in applied and natural science, computing, engineering, and engineering technology.

ACBSP: The Accreditation Council for Business Schools and Programs, formerly the Association of Collegiate Business Schools and Programs is a U.S. organization offering accreditation services to business programs focused on teaching and learning.

ACCA: The Association of Chartered Certified Accountants is a global professional accounting body offering the Chartered Certified Accountant qualification.

ACEEU: The Accreditation Council for Entrepreneurial and Engaged Universities is a newly formed council dedicated to recognizing and promoting entrepreneurial and engaged universities. Initiated by the University-Industry Innovation Network, it is driven by an international group of experts in engagement and entrepreneurship.

ASAP Methodology: Stands for Accelerated SAP is a standard SAP-related project preparation and systems implementation method, developed and updated by consultants that are involved in implementing SAP.

BBP: Stands for Business BluePrint is a document presenting the identified business models, best practices, analyzing the gaps and personalizing the process while preserving its efficiency.

CNA: Stands in Spanish for “Consejo Nacional de Acreditación” is the council responsible for defining the quality policy in higher education in Colombia.

COLCIENCIAS: The Administrative Department of Science, Technology, and Innovation is the Colombian governmental institution in charge for defining and implementing the National System of Science, Technology and Innovation.

CPM: Stands for Critical Path Method, it is a project management technique that analyzes what activities have the least amount of scheduling flexibility, predicting project duration.

EBITDA: Stands for Earnings Before Interest, Taxes, Depreciation, and Amortization is an accounting measure for profitability.

ERP: Stands for Enterprise Resource Planning, it is the integrated management of main business processes, often in real-time and mediated by software and technology as a suite of integrated applications.

ICT: Stands for Information and Communications Technology, is a general term for Information Technology that stresses the role of unified communications and the integration of telecommunications and computers, as well as necessary enterprise software, middleware, storage, and audiovisual systems, that enable users to access, store, transmit, and manipulate information.

IS: Stands for Information Systems, are formal, sociotechnical, organizational systems designed to collect, process, store, and distribute information.

ISO: The International Organization for Standardization is an international standard-setting body composed of representatives from various national standards organizations promoting worldwide proprietary, industrial and commercial standards.

IT: Stands for Information Technology, it is the use of computers to store, retrieve, transmit, and manipulate data.

KPI: Stands for Key Performance Indicator, it is a type of performance measurement to evaluate the success of an organization or of a particular activity.

PERT: Stands for Program Evaluation and Review Technique, it is a representation of a project's schedule, showing the sequence of tasks and the critical path of tasks that must be completed on time in order for the project to meet its completion deadline.

PMO: Stands for Project Management Office, it is a team that sets, maintains and ensures standards for project management across that organization.

SAP: Stands for Systems Applications and Products in Data Processing, is an ERP software as well the name of a company founded in 1972. It is a number of fully integrated modules covering every aspect of a business model.

SNIES: Stands in Spanish for "National Higher Education Information System," is an information system that has been created to provide the necessary information of the Colombian higher education sector, that allows planning, monitoring, evaluation, advice, inspection, and surveillance of the sector.

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