# Design of a Framework for Leadership Skills in Project Management

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**Abstract:** This research had as primary objective the design of a framework for leadership competence associated with project management in the training of industrial engineering professionals at universities in Bogotá, Colombia. This focus arises from the observed absence of this competence in recent university graduates, due to universities limit their education to technical skills.

The research was conducted through a sequential exploratory design using a mixed method. To achieve the research objective, characterizing leadership models associated with project management which have been designed and theorized by academia and leading project management organizations worldwide, was important to identify variables to be developed in this research. After characterizing the most relevant aspects of leadership in project management, the leadership competence associated with project management in students of professional careers at universities in Bogotá, Colombia was diagnosed. This allowed the generation of relevant data which were analysed and statistically treated, facilitating not only the generation of recommendations for academia, but also the design of a framework for leadership in project management.

The outcome of this research was significant to the field of study of projects and enabled the generation of a final deliverable which is functional and generalizable for universities in Bogotá, Colombia, contributing to the strengthening of leadership competence associated with projects in professional training. Finally, this research underscores the complexity and centrality of leadership in project management, highlighting the need for an adaptive and practical framework for leadership skills training which guides the education of the future professionals with holistic and applicable skills to inspire and effectively lead in volatile and ambiguous environments.

**Keywords:** educational standards; leadership skills; leadership structure; learning outcomes; project management.

# Diseño de una Estructura para Habilidades de Liderazgo en la Gerencia de Proyectos

**Resumen**: Esta investigación tenía como objetivo principal el diseño de una estructura para la competencia de liderazgo asociada con la gerencia de proyectos en la formación de profesionales de ingeniería industrial en universidades de Bogotá, Colombia. Este enfoque surgió como resultado de la limitada formación de esta competencia en los recién graduados, debido a que las universidades limitan su educación en habilidades técnicas.

La investigación se llevó a cabo mediante un diseño exploratorio secuencial utilizando un método mixto. Para lograr el objetivo de la investigación, la caracterización de los modelos de liderazgo asociados con la gerencia de proyectos que han sido diseñados y teorizados por la academia y las principales organizaciones en gerencia de proyectos a nivel global para identificar las variables a desarrollar en esta investigación. Después de caracterizar los aspectos más relevantes del liderazgo en la gerencia de proyectos, se diagnosticó la competencia de liderazgo asociada con la gerencia de proyectos en estudiantes de carreras profesionales en universidades de Bogotá, Colombia. Esto permitió la generación de datos relevantes que fueron analizados y tratados estadísticamente, facilitando no solo la generación de recomendaciones para la academia, sino también el diseño de una estructura de liderazgo para la gerencia de proyectos.

El resultado de esta investigación fue relevante para el campo de estudio de los proyectos y permitió la generación de un entregable final que es funcional y generalizable para las universidades en Bogotá, Colombia, contribuyendo al fortalecimiento de la competencia de liderazgo asociada con proyectos en la formación profesional. Finalmente, esta investigación subraya la complejidad y centralidad del liderazgo en la gerencia de proyectos, destacando la necesidad de una estructura adaptativa y práctica para la formación de habilidades de liderazgo que guíen la educación de los futuros profesionales con habilidades holísticas y aplicables, para inspirar y liderar eficazmente en entornos volátiles y ambiguos.

**Palabras clave:** estándares educativos; habilidades de liderazgo; estructura de liderazgo; resultado de aprendizaje; gerencia de proyectos.

## Introduction

*Leadership context and its importance*

Leadership has been identified as an essential personal competence not only for facing the challenges of the 4.0 industrial revolution, but also for business success. In the context of the industrial revolution 4.0, leadership takes a particularly human dimension, emphasizing the need for an approach that focuses its attention on personal skills and abilities [1-3]. This vision is shared by managers of diverse organizations, who consider leadership not only as a valuable competence, but also as an essential element for achieving organizational objectives and the success of projects. The importance of having professionals with developed leadership skills is relevant to positively impact on business dynamics and outcomes [4]. This convergence of perspectives highlights leadership as a critical variable for innovation, Project Management (PM), and business sustainability in the era of digitalization and automation.

Contemporary organizations increasingly value the development of interpersonal skills or *power skills* [5]. This has motivated the inclusion of professionals trained in educational institutions that emphasize these competencies in their curricula. The World Economic Forum anticipated that automation and technological advances could result in the loss of 85 million jobs by 2020, underscoring the importance of a rapid adaptation to the changing labour landscape through the acquisition of these personal skills [6]. Countries like the Kingdom of Saudi Arabia and Australia are reforming their educational systems to meet these needs, facing significant challenges, including the COVID-19 pandemic, which demand a rethinking of educational offerings to guarantee the professional future of new generations [6].

*Current state of the research field*

For the development of this research, an extensive literature review was conducted, where the search for academic articles and documents were essential for understanding the theme under research. The international and national analysis on leadership competence highlights the importance and the need for integrating leadership training. Countless studies have focused on the development of leadership skills among students, recognizing the relevance of these skills and abilities for professional success in the business sector.

Internationally, the following research studies in this field were identified.

- In the Autonomous Community of Aragon, Toledo, et al. [7] identified a shared perception among managers and teachers about the insufficiency of leadership training within educational institutions, highlighting the need to improve training programs to include social, communication, mediation, and conflict resolution skills. This research suggested that leadership training should be inclusive and encompass the entire educational community, including students and teachers to enhance the development of this essential competency.

- Dávila Quintana, et al. [8] focused on the impact of teaching methods and practices in higher education on leadership development, concluding that a combination of pedagogical approaches facilitates the development of leadership competencies in students, which benefits their job performance. This research underscored the importance of preparing graduates to demonstrate leadership from the beginning of their professional career.

- Bruce and Stephens [9] addressed the development of specific tools to facilitate leadership learning. They proposed a toolkit for leadership learning facilitators which supports the transition of students from high school to college and from college or universities to the workplace. Yen, et al. [10] described the development of a digital toolkit, at the University of Washington, was aimed at promoting leadership among academic staff, highlighting the need for professional development opportunities focused on leadership skills.

Nationally, the following research in this field of study was identified.

López [11] examined student leadership at the Santo Tomás University in Bucaramanga, Colombia, proposing a training program in social and political leadership. This research recognizes leadership training as an important need to face current social challenges, highlighting deficiencies in communicative skills and group management as key areas for improvement.

The review of additional literature, represented in other scientific articles, complements these findings, emphasizing the relevance of leadership not only in the educational context, but also in PM and in a broader professional sphere. The inclusion of leadership training in university curricula emerges as an imperative to provide future professionals with the necessary competencies to navigate and succeed in dynamic and challenging work environments.

## Methodology

This research was conducted as a mixed-method study with a descriptive scope because data collection was performed qualitatively and quantitatively. The integration of these methods allowed a discussion of the gathered information to gain a better understanding of leadership competency. Mixed-method research enables the expansion and enhancement of knowledge about the objects or phenomena under study through the use of numerical and textual variables, formulas, and narratives, that is, the combination of quantitative and qualitative approaches [12]. The application of the mixed method arose from the need for addressing the complexity of the problem through different realities, facilitating not only the acquisition of objective concepts, but also subjective ones [13].

The mixed method allowed adding value to this research and conducting an in-depth analysis during the study of the problem, using two methodological approaches to mitigate the uncertainty of the results. The implementation of this method, however, required considering a larger number of perspectives during the research, which enabled a more holistic and comprehensive analysis of the problem and greater certainty in the scientific conclusions [12]. The capitalization and complementarity of qualitative and quantitative approaches meant that the weaknesses and strengths of both methods were considered, contributing firstly to a greater understanding of aspects related to leadership competency associated with PM, and secondly, to an increase in the confidence of the results concerning the analysis of the problem under study [14].

The Sequential Exploratory Design (SED) was also adopted for this research. This design allowed the analysis of quantitative data collected, to be developed based on qualitative information that was identified, thus connecting both types of data and enabling an integration of both approaches [12]. This comparison is followed by the presentation of a leadership framework for PM based on quantitative and qualitative results, allowing a

deepening of the results in favour of the research product [15]. Similarly, within this design, the derivative modality according to its characteristics was the foundation for the research development. The SED enabled the research to be conducted based on constructivist principles.

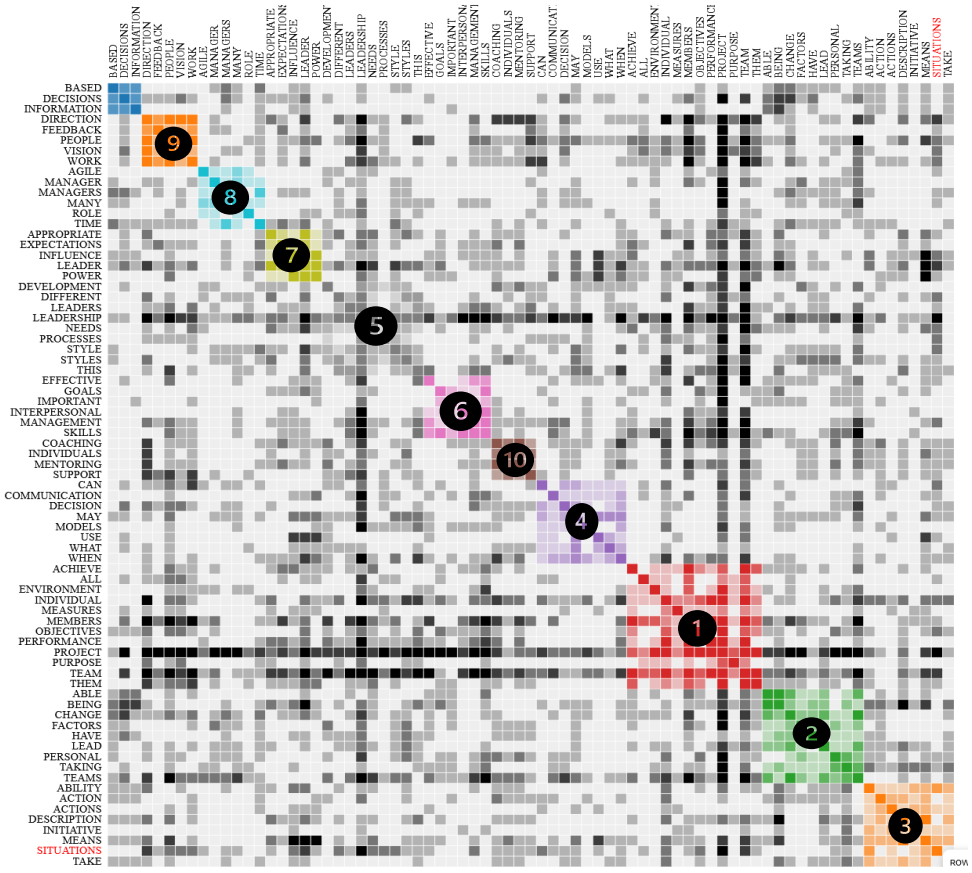
The SED was chosen because it possesses the necessary elements to develop instruments which facilitate the collection of relevant information, such as a diagnostic questionnaire [16]. This design generally comprises three phases to investigate a theme in depth. In the first phase, to characterize leadership models applicable to PM through a literature review, allowing the identification of variables to be developed in this research. In the second phase, the qualitative results enabled the design of an instrument to diagnose the leadership competency associated with PM and to administer the instrument to two groups, whose collected data was analysed statistically.

Finally, a shift was made to a post-positivism principle to identify and measure quantitative variables. The quantitative data were identified and interpreted in ways that generalized and expanded the qualitative results and could be employed in the proposal for designing a leadership framework for PM.

## Results

The initial result of this research was the generation of a co-occurrence matrix using the T-Lab software, which identified eleven (11) clusters (see Figure 1), which were lemmatized in relation to the group of words forming them. This matrix was generated thanks to the development of a qualitative approach, where a detailed review of the literature was conducted. The verification of eight of the main organizations (Project Management Institute® - PMI®; Centre of Excellence in PM² - PM², International Project Management Association – IPMA; Association for Project Management – APM; Projects in Controlled Environments - PRINCE2; Guidance on Project Management - ISO 21500; Australian Institute of Project Management – AIPM; and Project Management Association of Japan – PMAJ) focused on the study of PM at a global level was performed [16-19], allowing the analysis of specific information regarding leadership from guide books or texts on PM from these organizations to be the main inputs for the generation of the clusters. This verification ensured that the mentioned organizations encompassed knowledge developed in projects across different continents, such as: America, Asia, Europe, and Oceania.

**Figure 1.** Cooccurrence matrix




**Source:** Original development based on the use of the T-Lab software.

The outcomes of the qualitative analysis, that is, the eleven (11) clusters, facilitated the design of a questionnaire to diagnose leadership associated with PM in last semester students from universities in Bogotá, Colombia versus Colombian entrepreneurs to contrast the results. The questionnaire consisted of three (3) statements per cluster to be answered using the Likert scale. The questionnaire's questions were similar for both groups but with different wording. However, the questionnaire enabled the comparison of the mean of the independent populations. The *omega coefficient* was also applied to the questionnaire [20], as a method for estimating reliability to verify the accuracy of the instrument's results before applying it to the target populations.

The results of the diagnostic conducted on the two (02) independent populations underwent statistical analysis through SPSS software. The Mann-Whitney test was used to determine if there was a significant difference in the sum of ranks between the two groups. This analysis allowed the null hypothesis to be rejected in favour of an alternative hypothesis [21, 22]. Subsequently, the Kaiser-Meyer-Olkin (KMO) adequacy test was applied to determine the correlation between variables [23]. This statistical process enabled the validation of the clusters through an exploratory factor analysis. This technique was used to support, from a statistical perspective, which variables should be grouped into a single factor, thereby simplifying the clusters to facilitate their understanding under a statistical analysis which quantitatively justifies it.

As a result of the eleven (11) clusters generated qualitatively and once the quantitative analyses were applied using objective statistical tests, four (04) factors were generated that grouped clusters according to the correlation among the variables of the clusters (see **Table 1**). The factors were named based on the association of the lemmatization of the clusters that were grouped and the theme of their variables.

**Table 1.** Summary of clusters comprising the factors

| Factor | Clusters grouped by the factor | Denomination of the factor |
|---|---|---|
| 1 | C1 y C2 | Adaptive Team Management |
| 2 | C3, C4 y C5 | Strategic Adaptability and Effective Communication |
| 3 | C6 y C7 | Management of Influence and Integrated Skills |
| 4 | C8, C9, C10, C11 | Agility in Leadership and Support |

**Source:** original development based on an exploratory factor analysis of leadership diagnostic questionnaires of the 11 clusters, comparing the answers of the last semester industrial engineering students versus entrepreneurs.

Once the four factors and their respective variables (statements set to be answered through the Likert scale in the leadership diagnostic), which were between 06 and 11 variables per factor, were identified, an effort was made to simplify the planned framework in the research through a weighting verification of the factors' variables. This verification was developed using multiple linear regression models [24]. After conducting the statistical analysis, the two (02) variables of greatest statistical importance within each factor were established (see **Table 2**), becoming the main inputs to serve as a solid quantitative foundation in the design of a Framework for Leadership Skills in Project Management.

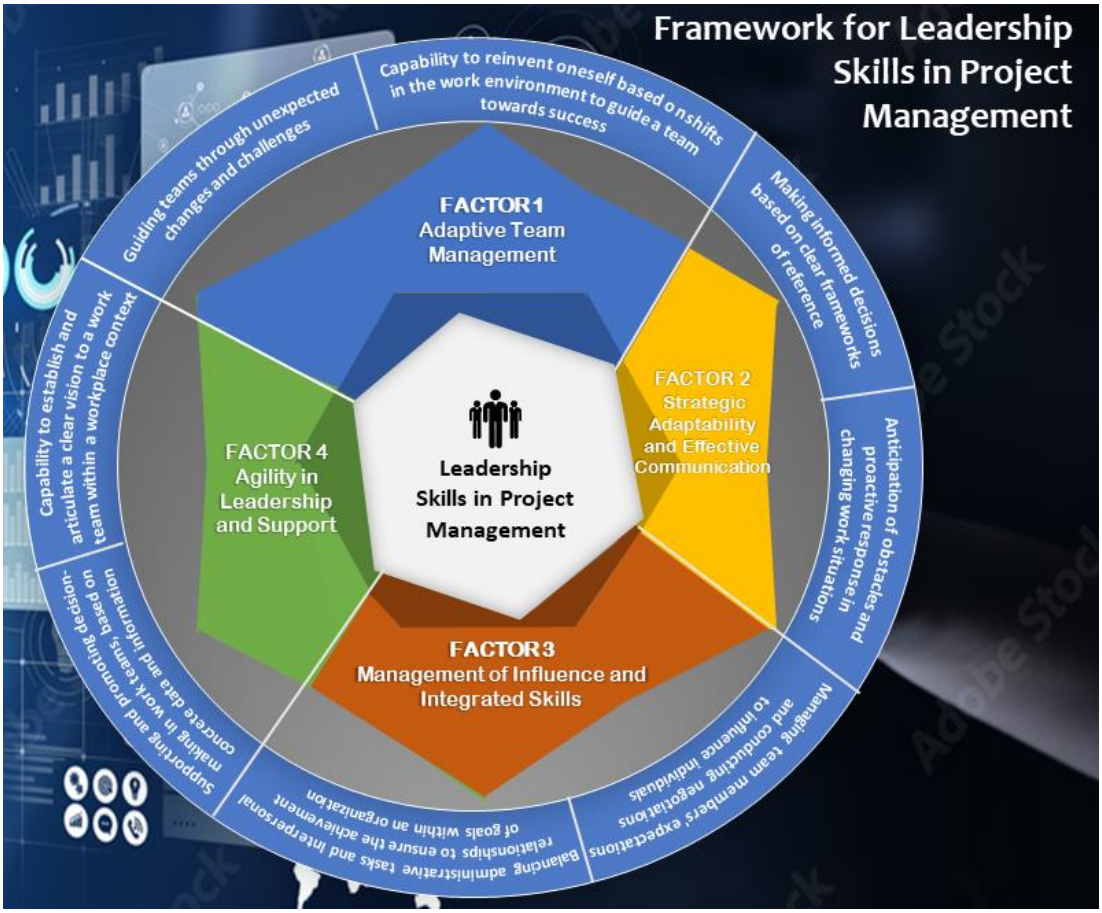
**Table 2.** Summary of variables comprising the factors

| Factors | Variables comprising the Factor | Variables' names |
|---|---|---|
| 1. Adaptive Team Management | Variable $_5$ | Guiding teams through unexpected changes and challenges. |
| | Variable $_6$ | Capability to reinvent oneself based on shifts in the work environment to guide a team towards success. |
| 2. Strategic Adaptability and Effective Communication | Variable $_{13}$ | Making informed decisions based on clear frameworks of reference. |
| | Variable $_8$ | Anticipation of obstacles and proactive response in changing work situations. |
| 3. Management of Influence and Integrated Skills | Variable $_{23}$ | Managing team members' expectations and conducting negotiations to influence individuals. |
| | Variable $_{17}$ | Balancing administrative tasks and interpersonal relationships to ensure the achievement of goals within an organization. |
| 4. Agility in Leadership and Support | Variable $_{33}$ | Supporting and promoting decision-making in work teams, based on concrete data and information. |
| | Variable $_{27}$ | Capability to establish and articulate a clear vision to a work team within a workplace context. |

**Source:** original development based on the use of multiple linear regression models, which allowed the identification of the most significant variables within each factor.

The outcome of the qualitative and quantitative analysis was a Framework for Leadership Skills in Project Management, which provides a holistic view of what encompasses leadership competency in PM (see Figure 2).

**Figure 2.** Framework for Leadership Skills in Project Management




**Source:** original development based on the analysis of the factors and their variables for the design of the current structure

## Conclusions

This research, conducted through the co-occurrence analysis of words with tools like T-LAB, demonstrated a close relationship between leadership and PM, highlighting the complexity of leadership. The identification of key terms such as leadership, teams, and communication revealed that leadership competency goes beyond merely supervising tasks to encompass comprehensive management involving team development, adaptability, and informed decision-making, pointing towards effectiveness and support which promote agility. The structuring of thematic clusters offered a clear perspective on how these terms intertwine within the project context, providing a replicable framework to enhance relevant leadership skills in PM.

Additionally, the research underscored a critical challenge in the educational field of industrial engineering programs, where, despite the commitment to foster leadership among students, there is a demonstrated need for a well-defined framework which encompasses leadership in PM for the field of industrial engineering knowledge, guiding the methodology of professional teaching. The diversity in teaching methods, far from being seen as a hindrance, presents multiple opportunities for innovation. However, this also highlights the importance of adopting a more adaptive and practical approach based on scientific research, to adequately prepare future professionals for the demands of the business environment.

This research proposed a Framework for Leadership Skills in Project Management as the result of a sequential qualitative and quantitative analysis aiming not only to theoretically strengthen leadership in the professional training of industrial engineers in relation to PM, but also to promote its practical application in real work contexts. Training industrial engineering leaders capable of guiding teams towards success in increasingly volatile and ambiguous global project-based markets was a priority during the development of this research and the research product could undoubtedly have a positive impact on orienting such training in a more functional way.

Finally, this document is the result of the master's research work in project management, titled: Toolkit for Strengthening Leadership Competency Associated with Project Management in Professional Training. This research was developed by the research group: Production and Innovation and Technology of the Faculty of Engineering at Universidad Militar Nueva Granada.

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