# HYBRID PROJECT MANAGEMENT MODEL FOR INDUSTRIAL SMES IN BOGOTÁ AND SABANA CENTRO

*Nataly Lorena Guarín Cortés*[*]
*Abraham González*[**]

Recibido:11/09/2024 • Aceptado: 26/11/2024
https://doi.org/10.22395/rium.v23n45a4

***ABSTRACT***

Globally, companies have had to adapt to market changes, especially in a post-pandemic context. In addition, in the last decade, there has been a significant increase in multivariate technique use in various fields of scientific research.

In Colombia, where small and medium-sized enterprises (SMEs) are fundamental to the productive apparatus due to their contribution to the productive fabric, this research proposes a project management model for industrial SMEs in Bogota and Sabana Centro so that they can adjust to a post-pandemic reality. This model aims to provide a tool that allows these organizations to overcome unfavorable market scenarios.

The study focused on industrial SMEs located in Bogota and Sabana Centro. Sixty-eight companies were selected by stratified random sampling with proportional allocation, to which a questionnaire composed of 19 estimation questions was applied. Subsequently, the study analyzed distinctive project management characteristics in these companies and developed a model using principal component analysis. This model is composed of 6 main factors and 24 components that contribute to strengthening organizations' strategic projection.

*Keywords:* Management, Projects, Management methodologies, Bogota, Sabana Centro, Model, Hybrid.

[*] Ingeniera Industrial. Especialista en Alta Gerencia y Magíster en Gerencia Integral de Proyectos, Universidad Militar Nueva Granada. Facultad de Ingeniería, Universidad Militar Nueva Granada. Sede Campus Nueva Granada. Km 2 vía Cajicá-Zipaquirá. Cundinamarca. Colombia. Profesor Asistente e Investigador Propylog. Facultad de Ingeniería, Universidad Militar Nueva Granada, ORCID: 0000-0002-8703-6211, e-mail: nataly.guarin@unimilitar.edu.co.

[**] Doctor en Ciencias Gerenciales con Énfasis en logística de la Universidad Rafael Belloso Chacin de Venezuela. Magister en gerencia de empresas con Énfasis en Mercado e Ingeniero Industrial de la Universidad de Zulia de Venezuela. Profesor Investigador Propylog. Facultad de Ingeniería, Universidad Militar Nueva Granada. Sede Campus Nueva Granada. Km 2 vía Cajicá-Zipaquirá. Cundinamarca. Colombia. https://orcid.org/0000-0002-3298-1902. e-mail: abrgasur@gmail.com

# MODELO HÍBRIDO DE GESTIÓN DE PROYECTOS PARA PYMES INDUSTRIALES EN BOGOTÁ Y SABANA CENTRO

***RESUMEN***

A nivel global, las empresas han tenido que adaptarse a los cambios del mercado, especialmente en un contexto pospandemia. Además, en la última década, se ha incrementado significativamente el uso de técnicas multivariadas en diversos campos de la investigación científica.

En Colombia, donde las pequeñas y medianas empresas (pymes) son fundamentales para el aparato productivo debido a su aporte al tejido empresarial, esta investigación propone un modelo de gestión de proyectos para pymes industriales en Bogotá y Sabana Centro, con el fin de que puedan ajustarse a una realidad pospandemia. Este modelo busca proporcionar una herramienta que permita a estas organizaciones superar escenarios de mercado desfavorables.

El estudio se centró en pymes industriales ubicadas en Bogotá y Sabana Centro. Se seleccionaron sesenta y ocho empresas mediante muestreo aleatorio estratificado con asignación proporcional, a las cuales se aplicó un cuestionario compuesto por 19 preguntas de estimación. Posteriormente, se analizaron las características distintivas de la gestión de proyectos en estas empresas y se desarrolló un modelo utilizando análisis de componentes principales. Este modelo está compuesto por 6 factores principales y 24 componentes que contribuyen al fortalecimiento de la proyección estratégica de las organizaciones.

Palabras clave: Gestión, Proyectos, Metodologías de gestión, Bogotá, Sabana Centro, Modelo, Híbrido.

## INTRODUCTION

Organizations are increasingly focused on achieving sustained competitive advantages that allow them to stay in markets over time [1] [2]. In addition, these entities have had to adapt their strategic planning due to a health crisis of unforeseen and unknown proportions worldwide. In the current post-pandemic context, Small and Medium-sized Enterprises (SMEs) face greater difficulties, where flexibility and the ability to adapt to changes represent the most significant challenges [3][4].

SMEs are a relevant sector for the countries where they are located, given their contribution to region development because they form solid business networks that boost productive activities [5]nacional e internacional, enfatizando el relativo incremento del valor agregado en ellos. En los países con ingreso bajo (menos de 1.000 dólares percápita. These companies, which according to [6] in Latin America in 2021, totaled around 1.04 million in 17 countries alone [7], generate from 60% to 70% of employment and are responsible for 50% of the world's Gross Domestic Product (GDP). However, despite their important contributions, they have to face many complications in their operation, as [3] expressed.

However, for these organizations, the situation COVID-19 caused generated production losses in labor-intensive sectors, which have suffered the impact of changing consumption and production patterns. [8]'s study confirmed this. That study concluded that 95% of companies were significantly affected by the COVID-19 crisis, especially micro and small enterprises in sectors like services, commerce, and industry.

Therefore, after these challenges, a need arises to recognize tools such as SME project management. These tools have allowed SMEs throughout history to improve and transform their business management. Also, they can serve as a reference for current SMEs to approach a recovery process guaranteeing efficiency and competitiveness so that they can successfully face the crisis resulting from the confinement and pandemic situation that the world is experiencing [9].

For the above, the application of multivariate statistical techniques for the design of a hybrid project management model for industrial SMEs in Bogotá and Sabana Centro in Colombia is significant due to the potential to generate competitive advantages, which allow them to adapt to the world's current dynamic conditions and survive in the post-pandemic.

## 1. MATERIALS AND METHODS

The analysis population is industrial SMEs located in Bogotá and Sabana Centro. Researchers used a database of SMEs obtained from a study information base.[8]. Subsequently, the economic sector conducted an advanced filter, ensuring they belonged to the industrial sector, reflecting the following results (See Table 1):

Table 1. Number of Industrial SMEs

| Location | Number of SMEs |
|---|---|
| Bogotá | 302 |
| Sabana Centro | 442 |
| TOTAL: | 744 |

Source: Author's compilation. Adapted from Bogota Chamber of Commerce (2020).

Researchers applied stratified random sampling with proportional affixation since, according to [10]. They determine a sample size proportional to the size of the corresponding stratum. In this study, the strata represent the location of the company in the same groups in Table 1. The number of industrial SMEs in the components studied is comparable, which supports a choice of the sampling method to characterize and analyze these companies appropriately and obtain relevant results.

The formula used was:

$$n=\frac{\sum W_h P_h \left(1-P_h\right)}{D+\frac{1}{N}\sum W_h P_h \left(1-P_h\right)} \qquad \text{Equation 1}$$

A 10% error, 50% P and Q values, and a 90% confidence level were considered, with the results reflected in Table No. 2.

Table 2. Sample size

| Location | Population | Ratio (W) | n (sample) |
|---|---|---|---|
| Bogotá | 302 | 40,6% | 26 |
| Sabana Centro | 442 | 59,4% | 38 |
| TOTAL: | 744 | 100,0% | 64 |

Source: Author's compilation.

In the first phase of this study, researchers identified the key variables to develop a project management model through a comprehensive review of relevant literature. They consulted Bibliographic sources and previous studies related to the topic to establish a solid basis to support the results of this work, especially regarding project management

models and methodologies. The search used specific keywords and equations that addressed topics like project management, SME project management, and project management models and methodologies in Spanish and English.

In the second phase, the data collection tool was validated using the Delphi Method with the participation of five experts. Researchers gathered data via a structured 19-question survey supported by a bibliographic review. The questionnaire included a total of 24 items (5 informative) designed to obtain information on known project management methodologies and practices implemented by selected companies, thus allowing a detailed analysis of collected data.

This study used Cronbach's Alpha coefficient to evaluate internal questionnaire consistency obtaining a 0.963 result, close to 1, and this indicates a high question coherence. This suggests that the questionnaire reliably measures a research construct, as [11] highlighted.

To apply the instrument, researchers contacted selected companies via email and provided the questionnaire. They processed collected data through a quantitative analysis that allowed characterizing the sample of companies through statistical variables.

In the last phase of this research, this study used a multivariate method to develop a final model through factor analysis. According to [12], factor analysis is a statistical technique that reduces the dimensionality of data by identifying coherent groups of variables from an extensive set. Its main objective is to determine the minimum number of dimensions necessary to explain the greatest amount of information contained in the data. [12]

Finally, a graphical tool was developed that would represent the hybrid model that combines aspects of various theoretical and applied project management methodologies.

## RESULTS

[13] defines project management as a set of tools to plan, organize, direct, and control project-associated events within a predetermined time, cost, and quality scenario [13].

To know the specific step by step to generate efficient project management, you have to define the methodology to follow. A methodology is a set of guidelines or principles, adapted as a list of processes, activities, tools, and techniques that are used throughout project life cycles [14].

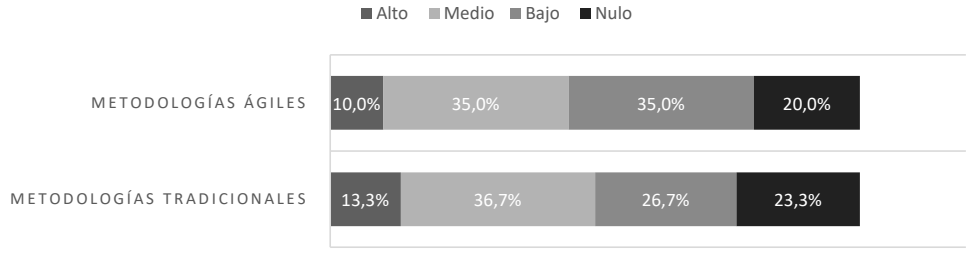
Among the most commonly used methodologies are traditional and agile [15][16] [14][17]. The cascade methodological approach is characterized by its sequentiality,

organizing tasks in project development phases or cycles. In addition, it is characterized by an absolute analysis of all the requirements of each phase. On the other hand, an agile project management methodology adapts work according to clients' final needs and users' expectations, characterized by flexibility, interactivity, and immediacy when adapting a project [18].

Of the traditional methodologies, the most common is based on PMI's PMBOK, which describes optimization practices and guidelines through 49 processes categorized into five process groups and ten fields of knowledge [19]. On the other hand, regarding agile, the best known is Scrum, which has organized teams and follows the principle of agility, where a project is executed in short fixed time blocks (iterations) and provides complete results [20].

Taking into account the results obtained in the data collection instrument, this study observed that, on average, 84% of 60 industrial SMEs, despite executing projects, do not implement any of the existing theoretical methodologies. Figure 1 shows the level of knowledge of project management methodologies in analysis companies.

Figure 1. Level of knowledge of project management methodologies in companies

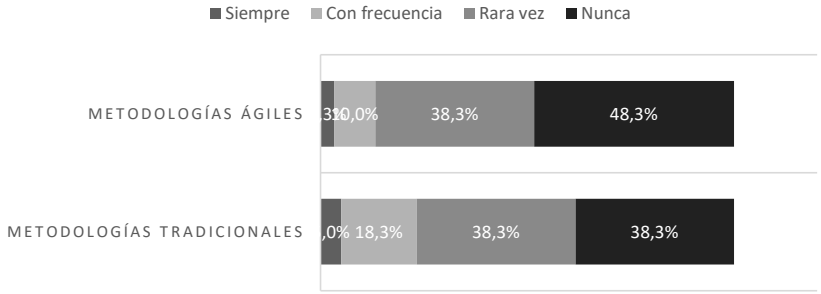



Source: Author's compilation.

This low or null level of knowledge in high proportions, as shown in Figure 1, shows the existence of gaps in the knowledge of the methodologies or their characteristic elements, as well as the advantages of organization project management in terms of profitability, increased productivity, and competitiveness. It is observed that, on average, more than 50% of businessmen do not know the traditional or agile project management methodologies.

Regarding implementing methodologies, SME managers recognize that, on average, more than 84% do not implement any methodology or do rarely it, as shown in Figure 2.

Figure 2. Implementation of project management methodologies



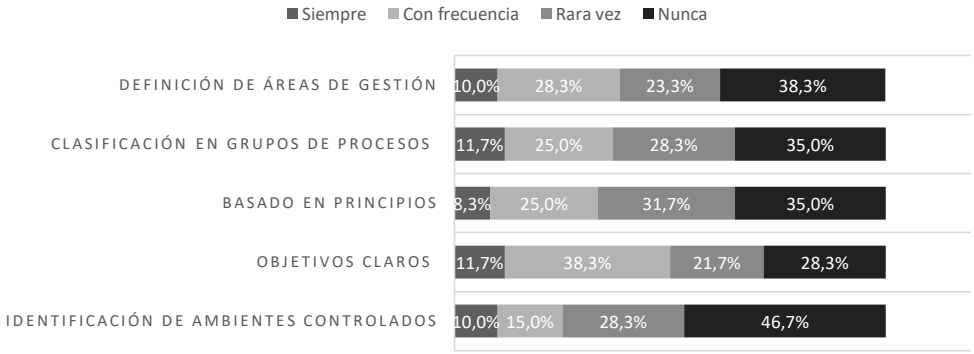

Source: Author's compilation.

It can be interpreted that there is no implementation of tools that allow effective management and follow-up methods of activities, changes, and risks that project management methodologies have.

To adapt the model to the characteristic practices of the main traditional and agile methodologies, the companies were asked about their degree of implementation of the main characteristic elements of each methodological system. This study chose the methodologies where the greatest gaps were identified.

This analysis begins with characteristic PRINCE2-based methodology elements, obtaining the results shown in Figure 3.

Figure 3. Implementation of characteristic elements of the PRINCE2-based methodology

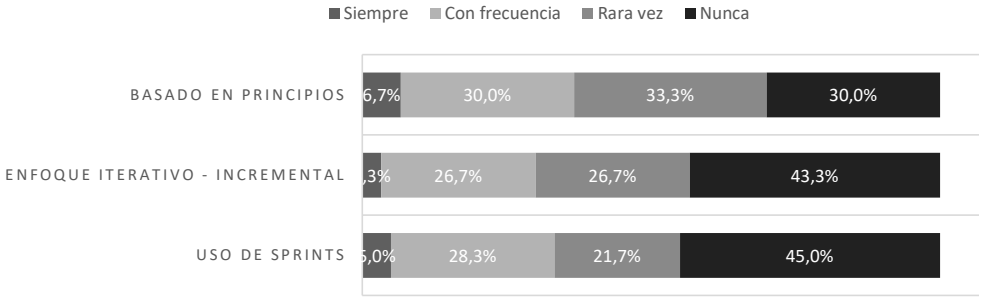



Source: Author's compilation.

As shown in Figure 3, the SMEs involved in the study do not define clear management departments, process groups, principles, or objectives. It is important to emphasize that if companies effectively implement these elements, they could achieve their objectives, meet their stakeholders' expectations, predict project actions and results, and increase the probability of success [21].

Continuing the analysis, the study investigated the implementation of characteristic Scrum methodology elements, as detailed in Figure 4.

Figure 4. Implementation of characteristic Scrum methodology elements

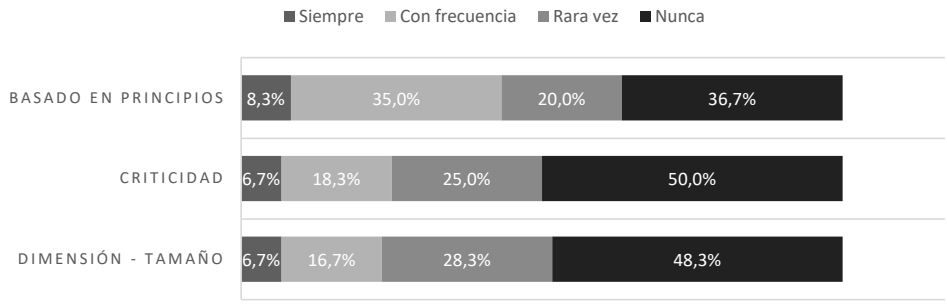



Source: Author's compilation.

As seen in Figure 4, the implementation of characteristic Scrum elements is also deficient because they do not implement factors such as the clear establishment of principles such as transparency, inspection, and adaptation, among other characteristic elements of Scrum-based methodology. If small and medium-sized companies in the industrial sector under investigation were to adopt these elements correctly, they could benefit from constant management of customer expectations based on tangible results, anticipation of results, flexibility, and adaptation to customer needs and market changes, among other benefits [22][23][14].

Regarding CRYSTAL methodology, we can see in Figure 5 that its characteristic elements are not frequently implemented in analysis organizations either even though they generate some advantages such as promoting productive efficiency and continuous improvement and enhancing collaboration and effective communication in any work team.

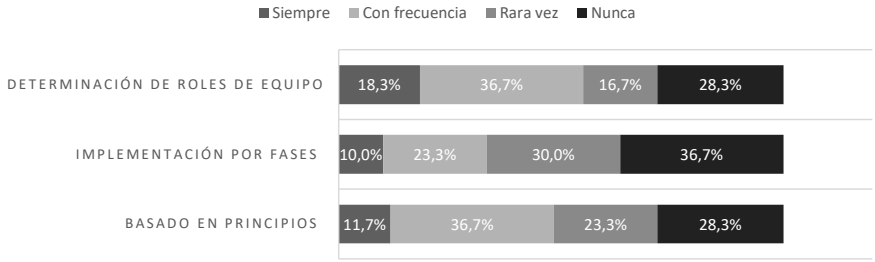
Figure 5. Implementation of characteristic CRYSTAL methodology elements




Source: Author's compilation.

On the other hand, DSDM is an agile method that focuses on the complete life cycle of the project. DSDM stood for Dynamic System Development Method, created in 1994 when managers were looking for an iterative way of working. It is based on eight principles, 5 phases, and team roles [15]. Figure 6 shows the low frequency of characteristic element implementation.

Figure 6. Implementation of characteristic DSDM methodology elements




Source: Author's compilation.

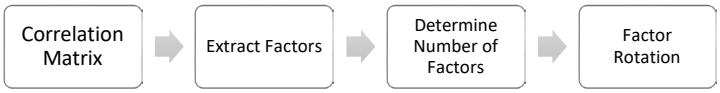
In this study, factor analysis was used based on information collected from 68 entrepreneurs from small and medium-sized industrial enterprises in Bogotá and Sabana Centro, who responded to the data collection instrument. This analysis allowed the identification of groups of variables with a relationship, which facilitates the reduction of the number of dimensions necessary to describe the project management model. This approach helps to close the gaps identified in the previously established objectives.

There are other techniques, such as analysis of variance or regression, but factor analysis was chosen since all variables are considered independent, that is, conceptual dependence of some variables on others is not assumed [12]. In addition, the purpose is to establish a structure of deep relationship between the variables of the analysis based on their correlation [24].

The choice of the statistical method to extract the new factors and determine the number to be analyzed was based on the authors [24], as they recommend the use of principal component analysis. [25] describes it as a multivariate statistical technique that facilitates the transformation of an original set of variables into a new set of variables without repetition or redundancy between them. These new variables are constructed as linear combinations of the original variables, organized according to their importance in terms of the total variability captured by the sample. [25]

[26], [12] and [27] describe a general methodology to implement this analysis, starting with a correlation matrix study, and then, extracting and determining the number of factors that make up the model, which after its rotation will result in the structure of the model, as shown in Figure 7. [26]

Figure 7. Factor analysis methodology.




Source: Author's compilation.

To verify the applicability of this technique, the correlation matrix is analyzed. It aims to confirm that variables are highly related to each other. Variables with a high correlation with each other also have a high correlation with the same factors or sets of factors.

Subsequently, to verify the applicability of the method under development, researchers applied the Kaiser Myer Olkin Test [27]. According to Marín (2006), the factor model is the relevant factor reduction method when the KMO value is greater than 0.6. IBM also supports this criterion (2022), which considers values greater than 0.5 as adequate. Figure 8 shows the results obtained in the SPSS software. The KMO test result was 0.75, confirming that factor analysis can be applied in this study. [28]

Figure 8. KMO and Bartlett Test Result

**Matriz de correlaciones[a]**

a. Determinante = 5,909E-35

**Prueba de KMO y Bartlett**

| | | |
|---|---|---|
| Medida Kaiser-Meyer-Olkin de adecuación de muestreo | | ,638 |
| Prueba de esfericidad de Bartlett | Aprox. Chi-cuadrado | 3270,778 |
| | gl | 1081 |
| | Sig. | <,001 |

Source: SPSS (2024)

As [29] described it, citing Pérez and Medrano (2010) suggesting that those factors whose total value is equal to or greater than one be included in the model, applying the factor extraction method. Table 3 establishes six factors with values greater than 1, which explain 79.06% of the total model variability.

Table 3. Total variance explained

| Componente | Varianza total explicada | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Autovalores iniciales | | | Sumas de cargas al cuadrado de la extracción | | | Sumas de cargas al cuadrado de la rotación | | |
| | Total | % de varianza | % acumulado | Total | % de varianza | % acumulado | Total | % de varianza | % acumulado |
| 1 | 17,846 | 37,971 | 37,971 | 17,846 | 37,971 | 37,971 | 9,583 | 20,388 | 20,388 |
| 2 | 5,048 | 1 0,740 | 48,71 0 | 5,048 | 10,740 | 48,71 0 | 5,724 | 2,179 | 32,567 |
| 3 | 4,41 2 | 9,387 | 58,098 | 4,412 | 9,387 | 58,098 | 5,125 | 1 0,904 | 43,471 |
| 4 | 3,200 | 6,809 | 64,907 | 3,200 | 6,809 | 64,907 | 4,935 | 1 0,4gg | 53,970 |
| 5 | 2,363 | 5,028 | 69,935 | 2,363 | 5,028 | 69,935 | 4,046 | 8,608 | 62,578 |
| 6 | 1,745 | 3,71 2 | 73,647 | 1,745 | 3,71 2 | 73,647 | 3,570 | 7,595 | 70,173 |
| 7 | 1,337 | 2,845 | 76,492 | 1,337 | 2,845 | 76,492 | 2,824 | 6,009 | 76,182 |
| 8 | 1,206 | 2,566 | 79,059 | 1,206 | 2,566 | 79,059 | 1,352 | 2,877 | 79,059 |
| 9 | ,984 | 2,095 | 81,153 | | | | | | |
| 10 | ,851 | 1,832 | 82,985 | | | | | | |

Source: SPSS (2024)

From the Varimax rotation method and after six iterations, the matrix reflected in Table 4 is obtained, reflecting the factors that make up the model. This matrix considers the variables analyzed in the SMEs under study based on traditional and agile methodologies. According to the parameterization carried out, values greater than 0.80 were preserved to simplify the model, although as [30] described it, factor loads are expected to be greater than 0.70 by sample size. [30]

Table 4. Varimax rotated the component matrix

| | Matriz de componente rotado' | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Componente | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 6.1 El Alcance | | | | | | 0,703 | | |
| 6.2 Tiempo | | | | | | 0,726 | | |
| 6.3 Costo | | | | | | 0,852 | | |
| 6.5 Riesgos | | | | | | 0,762 | | |
| 8.1 Buenas Prácticas (Documentación/HerramientasJTécnicas) | | 0,739 | | | | | | |
| 8.3 Secuencialidad definida del ciclo de vida proyecto | | 0,813 | | | | | | |
| 8.4 Control y revisión en cada fase | | 0,735 | | | | | | |

| | Matriz de componente rotado' | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Componente | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 8.5 Enfoque en procesos | | 0,762 | | | | | | |
| 9.2 Objetivos claros | 0,721 | | | | | | | |
| 9.3 Basado en principios | 0,782 | | | | | | | |
| 9.4 Clasificación en grupos de procesos | 0,857 | | | | | | | |
| 9.5 Definición de áreas de gestión | | | | | | | | |
| 11.1 Uso de Sprints | | | | | 0,757 | | | |
| 11.2 Enfoque terativo - incremental | | | | | 0,777 | | | |
| 13.2 Criticidad | 0,762 | | | | | | | |
| 13.3 Basado en principios | 0,745 | | | | | | | |
| 14.1 Basado en principios | 0,841 | | | | | | | |
| 142 Implementación por fases | 0,776 | | | | | | | |
| 15.1 Planeación | | | 0,850 | | | | | |
| 15.2 Inicio | | | 0,868 | | 0,757 | | | |
| 15.3 Ejecución | | | 0,902 | | 0,777 | | | |
| 15.4 Control | | | 0,841 | | | | | |
| 15.5 Cierre | | | 0,873 | | | | | |
| 18.1 Rentabilidad | | | | 0,850 | | | | |
| 18.2 Retorno de la inversión | | | | 0,921 | | | | |
| 18.3 Aumento de ingresos | | | | 0,865 | | | | |
| 18.4 EVA | | | | 0,787 | | | | |
| 18.5 Aumento de productividad | | | | 0,850 | | | | |
| 18.6 Competitividad en el mercado | | | | 0,778 | | | | |

Source: SPSS (2024)

## DISCUSSION

In the matrix resulting from the rotation, it is possible to observe not only the characteristic elements of the methodologies analyzed but also the main constraints to be considered, and the stages and expected results, as well as:

- Factor 1. Analyzing the main components of factor 1, this study observed that, according to what [31] referred to, are characteristic components of traditional

management methodologies since the areas are related to the fields of knowledge. The process-based approach relates to Process Groups, which are in the definition phase although they are independent of project phases when observing the elements of factor one. However, researchers say that they had to explain that the elements that make up this factor relate the instrument to traditional, agile, and hybrid methodologies.

  – Therefore, it is called *"Characteristic project management elements in planning processes"*

  – Components: Objectives, process-based approach, the definition of principles, establishment of management areas.

- Factor 2: Considering that one of the main elements of factor 2 is good practices, it is necessary to define them as "techniques and tools considered applicable in most projects, most of the time" and that "there is a consensus that the application of knowledge, skills, tools, and techniques to project management processes can increase the chance of success of a wide variety of projects to deliver expected business outcomes and values [31]. This definition is adapted to traditional methodologies based on PMBOK, as good practices are a standard of this category of methodologies, as [15] and [32] referred to.

  Therefore, this factor is denominated "*Characteristic elements of project management in execution processes - traditional methodologies*" since the particularity of sequentiality of stages refers to a waterfall model. [18]

  – Components: Good practices, sequentiality of stages, and focus on processes.

- Factor 3. This constituent can be associated with the PMBOK process groups, but it is also related to the project life cycle and its specific phases.

  As [33] described, the life cycle of a project is a set of phases through which it takes place from the moment it is born until it ends. Complementing the above, a phase or stage is defined as a set of activities, generally sequential, with an entity and related to each other, which cover a partial objective of the project [33].

  It is for this reason that this factor is denominated as the *"Stages or life cycle of the project."*

  – Components: Planning, Starting, Execution, Control, Closing.

- Factor 4. Theoretically supported by [34], the key factors for business transformation are related to the financial impact and an increase in competitiveness since it must contribute to the strategic projection of the company.

It is for this reason that factor 4 is named *"Business Transformation,"* focused on the results obtained by adequate project management adapted to organizations.

– Components: Profitability, Return on Investment, Revenue Increase, EVA, Productivity Increase, Market Competitiveness.

- Factor 5: When a *project sprint* is required, it is related to agile management methodologies. In a SCRUM-based methodology, these are defined as one-month or less fixed-length events to create consistency, and the work needed to achieve the product goal is within it [35]. On the other hand, The study observed that according to the authors who support this research, an iterative and incremental approach is used in agile management methodologies to optimize predictability and control risk.

  As described in the previous paragraph, this factor is called: *"Characteristic elements of project management in execution processes - agile methodologies"*

  – Components: *Sprint* uses an iterative, incremental approach.

1. Factor 6: As identified in traditional methodologies, specifically PMBOK-based methodologies, certain constraints must be managed in projects. Initially, some authors referred to the triple restriction of Scope, Time, and Cost [36][37], where if one of the variables is modified, the rest of the variables are also modified.

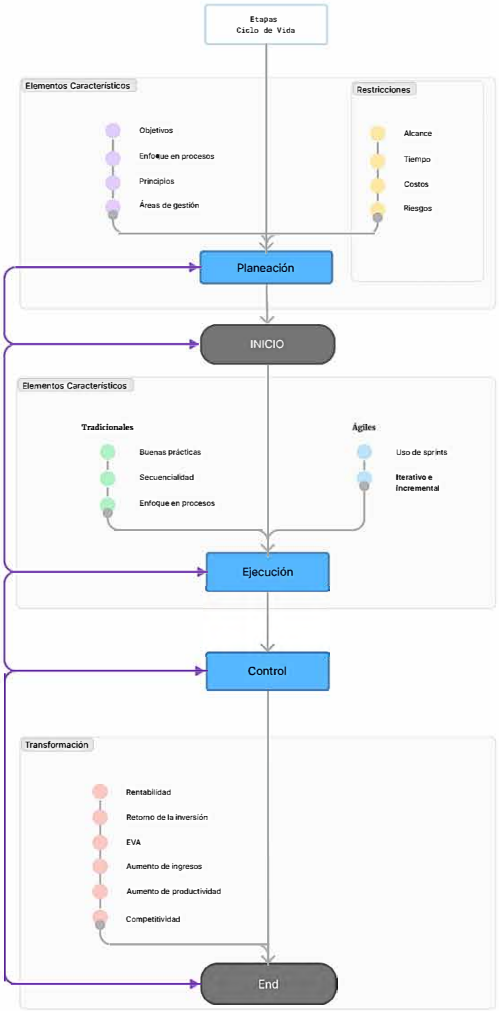
   In turn, [38], in the PRINCE2, describes these elements as performance objectives, including quality and risks.

   This factor is then called "*Constraints"*.

   – Components: Scope, time, cost, risks.

Now, taking into account the above, the factors and components are ordered, and the following project management model is proposed for industrial SMEs in Bogotá and Sabana Centro, shown in Figure 9.

Figure 9. Hybrid project management model for industrial SMEs in Bogotá and Sabana Centro




Source: Author's compilation.

The structure of the project management model for industrial SMEs in Bogotá and Sabana Centro is composed of the elements shown in Figure 10.

For your successful implementation, the study recommends to:

1. Verify the alignment of mission, vision, and strategic objectives with project management.
2. Consider the stages of planning, initiation, execution, control, and closing in each project.

3. For the project planning stage, entrepreneurs should consider:
   - Setting clear objectives aligned with the restrictions;
   - Defining the processes impacted by the project and their approach;
   - Determining principles (business culture and transformation, project management experience, determining roles and responsibilities - organizational chart, focus on products, adaptation to the project, continuous communication);
   - Consider management fields (documented plans, quality of deliverables, identifying the risks of each phase and periodic reviews, continuous analysis of how a project is progressing).
4. At the project implementation stage, review:
   - Good Practices (Documentation/Tools/Techniques);
   - Sequentiality of stages, without forgetting product interactivity and incrementality;
   - Focus on processes;
   - Use of sprints or periodic meetings with a partial project deliverable review;
5. Perform control of results by monitoring indicators such as profitability, return on investment, increase in revenue, EVA (Economic Value Added), productivity, and competitiveness in the market.

The study explains that manager training in topics related to project management, management methodologies, and characteristic elements is a priority in SMEs.

It is necessary to explain that the hybrid model outlined is the result of project management based on the methodologies used. As [39]described it, on a methodological level, hybrid project management involves combining different methodologies or elements of different methodologies. [39]

It is understood that this is a hybrid management model since it fuses characteristic elements of both traditional and agile methodologies. This combination allows you to take advantage of the responsiveness and adaptability of the agile approach while benefiting from traditional frameworks. By designing a hybrid management model, a significant impact is generated on the achievement of objectives, response times, and the added value of the product. In addition, this approach guides organizations to meet customer needs and adapt to market changes [40].

The model obtained is classified as a spiral model [15] described since, as shown in Figure 10, the purple arrows have feedback between stages, integrating iteration and dynamism, along with a cascade model, due to the importance of their sequentiality.

This shows that it is possible to design a management model adapted to companies' characteristics. Regarding the hybrid model [41] described, it is evident that there is a similarity in factors involved, such as business cultures, methods or tools used in the methodology, and the competence of the project management staff.

Regarding the level of knowledge of general and specific management methodologies, it is highlighted that the success of any organizational transformation depends, to a large extent, on employees' skills and competencies. Investing in training and personal development is crucial to ensure that teams are prepared to face new challenges. Business transformation is built through continuous training and solid foundations.

## CONCLUSIONS

The hybrid project management model for industrial SMEs in Bogotá and Sabana Centro was the result of a multivariate analysis using a principal component factor analysis method and was made up of six factors and 24 components, as follows: Factor 1, *"Characteristic elements of project management in planning processes"* whose components are: objectives, process-based approach, definition of principles, establishment of management fileds; Factor 2, "*Characteristic elements of project management in execution processes - traditional methodologies*", modules: good practices, sequentiality of stages and approach to processes; Factor 3, *"Stages or life cycle of the project", components: planning, initiation, execution, control, closing; Factor 4: "Business transformation",* comprising: profitability, return on investment, revenue growth, EVA, productivity gain, market competitiveness; Factor 5, "*Characteristic elements of project management in execution processes - agile methodologies*", components: Use of *sprints*, iterative and incremental approach; and Factor 6, "*Constraints*", units: scope, time, cost, risks.

## ACKNOWLEDGEMENT

Universidad Militar Nueva Granada (Military University).

## BIBLIOGRAPHIC REFERENCES

[1] M. Narváez and G. Fernández, "Estrategias competitivas para fortalecer sectores de actividad empresarial en el mercado global," *Rev. Venez. Gerenc.*, vol. 13, no. 42, pp. 233–243, 2011, doi: 10.31876/revista.v13i42.10495.

[2] J. Weller, "La pandemia del COVID-19 y su efecto en las tendencias de los mercados laborales Gracias por su interés en esta publicación de la CEPAL," *CEPAL*, vol. Publicació, 2020.

[3] M. Álvarez, "Manual de la micro, pequeña y mediana empresa: una contribución a la mejora de los sistemas de información y el desarrollo de las políticas públicas. Recuperado de [Consulta: 27 de Abril del 2020]," 2009. [Online]. Available: https://repositorio.cepal.org/bitstream/handle/11362/2022/1/Manual_Micro_Pequenha_Mediana_Empresa_es.pdf

[4] J. Adan, L. Munar, Gu. Romero, and A. Gordillo, "Nuevos desafíos de las pequeñas y medianas empresas en tiempos de pandemia," *Catalina,* vol. 26 (72), pp. 185–208, 2022.

[5] A. Gil and J. Jiménez, "El contexto económico global de la PYME," *Páginas Rev. académica e Inst. la UCPR*, no. 95, p. 4, 2014.

[6] CEPAL, "Estudio Economico Colombia 2020," *Cepal*, pp. 1–10, 2021, [Online]. Available: https://repositorio.cepal.org/bitstream/handle/11362/46070/96/EE2020_Colombia_es.pdf

[7] M. Dini and G. Stumpo, *en América Latina Un frágil desempeño y MIPYMES Gracias por su interés en esta publicación de la CEPAL*. 2020.

[8] Cámara de Comercio de Bogotá, "Base de datos empresas de sabana centro y Bogotá." 2020.

[9] ACOPI y FAEDPYME, "Relexiones y propuestas para la reactivación y fortalecimiento de las mipymes en Colombia en el marco del COVID-19," p. 42, 2020.

[10] R. Morales, "Fundamentos de Muestreo," 2019.

[11] D. Frías-Navarro, "Apuntes de estimación de la fiabilidad de consistencia interna de los ítems de un instrumento de medida," *Univ. Val.*, pp. 1–31, 2024.

[12] S. De la Fuente, "ANÁLISIS FACTORIAL," 2011.

[13] A. Terrazas, "MODELO CONCEPTUAL DE GESTION DE PROYECTOS," 2009.

[14] J. Aguirre and S. Aguirre, "Metodologías para el desarrollo de Proyectos," pp. 1–15, 2020.

[15] Á. Girón, "Metodologías de Gestión de Proyectos. Estudio comparativo y propuesta de guía de elección.," 2021.

[16] DIAN, "Metodología de Gestión de Proyectos," 2020.

[17] S. Maiti, "Project Management," *Educatonleaves*, 2021, [Online]. Available: https://educationleaves.com/project-management/

[18] Digital Talent Agency, "Metodologías de gestión de proyectos," pp. 1–16, 2018.

[19] K. Morales, "GESTIÓN DE PROYECTOS BAJO LA METODOLOGÍA PMBOK EN EL SECTOR PYMES DE INGENIERÍA EN COLOMBIA," Bogotá - Colombia, 2022.

[20] L. Amejilde, "Gestión de proyectos según el PMI," *España Creat. Commons*, vol. 3, p. 70, 2016, [Online]. Available: http://openaccess.uoc.edu/webapps/o2/bitstream/10609/45590/7/lameijideTFC0116memoria.pdf

[21] PMBC, "Ventajas del PMI en la gestión de proyectos." España, 2024. [Online]. Available: https://pmbc.es/ventajas-del-pmi-en-la-gestion-de-proyectos/

[22] K. Schwaber, J. Sutherland, L. Guía, D. De Scrum, and L. Reglas, "La Guía Scrum," 2020.

[23] Universidad Internacional de la Rioja, "Qué es la planificación de proyectos y cómo se hace," 2023. https://unirfp.unir.net/revista/empresa/planificacion-de-proyectos/

[24] C. Méndez and M. Rondón, "Introducción al análisis factorial exploratorio," *Rev. Colomb. Psiquiatr.*, vol. 41, no. 1, pp. 197–207, 2012.

[25] Marín, "Tema 3: Análisis de Componentes Principales," 2006. https://halweb.uc3m.es/esp/personal/personas/jmmarin/esp/amult/amult.html

[26] O. Montoya, "Aplicación del análisis factorial a la investigación de mercados. caso de estudio," *Sci. Tech. Año XIII, Univ. Tecnológica Pereira*, vol. 35, pp. 281–286, 2007.

[27] Universidad de Granada, "Fases de un Análisis Fcatorial," España, 2014. [Online]. Available: https://wpd.ugr.es/~bioestad/guia-spss/practica-3/

[28] IBM, "Utilización del análisis factorial para la reducción de datos." 2022. [Online]. Available: https://www.ibm.com/docs/es/spss-statistics/saas?topic=analysis-using-factor-data-reduction

[29] A. González and C. Calderon Casallas, "MODELO DE GESTIÓN DE PROYECTOS PARA LA CREACIÓN DE VALOR, ENFOCADO A LAS PYMES INDUSTRIALES DE PROVINCIA SABANA CENTRO," pp. 1–154, 2021.

[30] L. Monroy, "Cuaderno técnico 6. Análisis factorial: una técnica para evaluar la dimensionalidad de las pruebas," *Univ. Nac. Autónoma México*, 2010.

[31] PMI, *PMBOK. Versión 6. Dirección de proyectos*. 2017.

[32] M. Pérez and J. Montes de Oca, "COMPARACION DE METODOLOGIAS DE GERENCIA DE PROYECTOS PRINCE2 Y," 2014.

[33] D. Tapias, "Escuela Politécnica Superior," 2014.

[34] Delloite Consulting, "Transformación Empresarial en México Encuesta 2015." 2018.

[35] K. Schwaber and J. Sutherland, *La Guía Scrum. La Guía Definitiva de Scrum: Las Reglas del Juego.* 2020.

[36] P. Lledó, "¿ Qué es la restricción triple de un proyecto ?," p. 20, 2014.

[37] Tecnológico de Costa Rica, "Triple Restricción," 2017.

[38] IPMO, "IPMO Guide PRINCE2®." 2017. [Online]. Available: https://ipmoguide.com/prince2-actualizacion-a-2017/

[39] J. Vila and S. Capuz-rizo, "Definiendo la gestión híbrida de proyectos," 2022.

[40] L. Laurent, "Métodos de gestión de proyectos tradicionales frente a métodos ágiles: ¿cuál se adapta mejor a usted?," 2022. [Online]. Available: https://appmaster.io/es/blog/tradicional-vs-agil-es

[41] T. J. Cooke-davies and A. Arzymanow, "The maturity of project management in different industries : An investigation into variations between project management models," *Int. J. Proj. Manag.*, vol. 21, no. 6, pp. 471–478, 2003, doi: 10.1016/S0263-7863(02)00084-4.