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# COLLABORATIVE MANAGEMENT PRACTICES FOR HIGH-RISE BUILDING DESIGN

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## ABSTRACT

Recently, interest in collaborative management practices in high-rise building design has grown significantly, as evidenced by an increasing number of publications in the last decade. However, existing research does not comprehensively address the effectiveness of these practices in design performance, nor does it provide a prioritized list to facilitate their implementation to improve collaboration and coordination in this crucial phase. This study aims to propose collaborative management practices specifically designed for the design phase in high-rise building projects to enhance the productivity of design teams and ensure project success. A three-step methodology was adopted: (1) identify activities that do or do not contribute value to design management; (2) describe relevant collaborative management practices; and (3) validate the relationship between these practices and design team performance. As a result, 15 key practices were defined, highlighting the five most important: phased project planning, long-term supplier relationships, solution implementation and tracking, verification and documentation of results, and efficient organization of project information. While these practices have proven effective, their validation in real projects and adaptation to different contexts, such as smaller-scale projects, are areas for future study.

## KEYWORDS

Practices; management; collaborative; value activities; high-rise buildings.

## INTRODUCTION

High-rise buildings have become a characteristic symbol of modern urban areas, resulting from the need to maximize the use of space in densely populated cities. These buildings pose significant challenges in terms of sustainability, safety, and planning (Giyasov & Giyasova, 2018). In this context, the design phase of high-rise building projects plays a fundamental role, as it involves multiple professionals who form temporary organizations. As Koskela (2005) points out, this distinctive feature of the architecture, engineering, and construction (AEC) industry sets it apart from other sectors. In these temporary organizations, coordination and effective communication are essential to achieve coherent and functional design (Svalestuen et al., 2015). In addition, proper management is the cornerstone of any project and is critical to its overall success and performance (Kabirifar & Mojtahedi, 2019). Design management, defined as applying professional skills to coordinate and optimize the design process, is crucial to meet

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or exceed client and team expectations (Park et al., 2016). This function is particularly important in complex, multidisciplinary projects, where efficient and high-quality delivery is sought through fully integrated design (Park et al., 2016). Design teams are key in creating concepts and aligning client requirements with the project before the planning phase (Herrera et al., 2023; Oluwatayo & Amole, 2013). Since design is a complex process, its management must ensure effective participation, communication, and stakeholder coordination to achieve successful development (Herrera et al., 2023). In addition, effective project management practices directly influence success, highlighting the importance of fostering collaboration and communication (Vicente-Oliva et al., 2015).

Previous research has addressed the interactions between participants in the design of building projects. Herrera et al., (2023) delve into the dynamics and improvement plans of teamwork in this type of project. They also identified practices applied in the design phase that influence the project's success, such as identifying stakeholder requirements, client participation in the design phase, collaborative project planning, and product design. The relevance of activities related to value generation in projects has also been highlighted, such as leisure activities, stakeholder feedback, and waiting for inventory (Emuze et al., 2014). However, although the studies have identified practices and activities relevant to design management, there are no studies on how the two concepts – collaborative management practices and design-related activities – are connected and, thus, on the influence that practices have on the efficiency of design teams in terms of coordination and communication, and on the project in general. This gap in the literature highlights the need to analyze in depth the impact of management practices on the performance of design teams and propose the most effective ones. This research aims to (1) identify value-adding and non-value-adding activities in high-rise building design, (2) identify and describe key collaborative management practices relevant to design, and (3) assess the relationship between these practices and design team performance.

# METHODOLOGY

The research method was divided into three stages: (1) identifying value-adding and non-value-adding activities in design management, (2) describing collaborative management practices for high-rise building projects, and (3) validating the relationship between collaborative practices and design teams. The first stage relied on a comprehensive literature review from Scopus and Web of Science, supplemented by the Snowball search technique to address initial data insufficiencies. This method identified 31 relevant documents on design activities. A homologation process ensured clear, unambiguous interpretations of these activities for accurate analysis. This process involved: (1) identifying similar activities or practices across sources; (2) grouping them under unified terminology; and (3) validating these groupings through expert review to ensure conceptual alignment and relevance. This step ensured a coherent and comparable dataset for the subsequent analysis. The activities were subsequently categorized based on the literature of Zhao et al. (2003), Emuze et al., (2014) and Han et al. (2007) whose works provide relevant and accurate classifications for projects. These references made it possible to group the activities into three major subcategories: (a) Productive activities, (b) Contributory activities, and (c) Non-contributory activities. Once homologated and categorized, a panel of five experts validated the proposed activities and their classification. This process focused on evaluating the relevance and appropriateness of the categories and was carried out iteratively until the approval of the professionals was obtained.

The second stage focused on describing collaborative management practices for high-rise building design, divided into two sections. The first involved an exhaustive literature review, yielding 61 documents on potential practices, categorized into six groups: stakeholder management, project planning and control, problem-solving and decision-making of Herrera et al., (2020), and three new categories—design development, innovation and continuous improvement, and motivation and team. Practices were homologated and classified for accuracy. The second section analyzed the link between practices and their relationship with activities, validated by eight experts in building design. This quantitative analysis identified the most influential and effective practices for improving design efficiency. Eight experts in building design assessed whether each practice positively or negatively influenced the occurrence of the identified activities. Their evaluations were compiled in a matrix, using a binary system: a "+" indicated a positive contribution (increased frequency or encouragement of the activity), while a "–" indicated a mitigating effect (reduction or control of the activity). The number of relationships established per practice was then used to identify the most influential practices for improving design efficiency.

The third stage aimed to determine the relationship between collaborative management practices and project design teams using a SurveyMonkey survey targeted at design management professionals. The survey had two sections: the first assessed professionals' knowledge of the practices using a five-point Likert scale (1 = no knowledge, 5 = advanced knowledge) with responses from 49 participants. The second evaluated the importance of practices in projects based on personal experience. A validation matrix assessed practices under four criteria: (a) effectiveness, (b) collaboration, (c) applicability, and (d) added value. Criteria (a)-(c) were rated by 33 professionals on a five-point Likert scale, while (d) was scored based on the number of related activities. Responses determined each practice's potential impact, ranking them by their contribution to design team performance and project success. Practices with the highest scores were identified as most effective in optimizing collaboration, while others were flagged for potential adjustments or increased focus during implementation. Experts were selected based on two main criteria: (1) at least five years of experience in managing or coordinating design processes in high-rise building projects, and/or (2) academic research or consulting experience in collaborative design management. The sample sizes were consistent with exploratory research objectives and comparable to previous studies addressing similar topics in the AEC industry

# RESULTS AND DISCUSSIONS

## VALUE-ADDING AND NON-VALUE-ADDING ACTIVITIES.

In the design phase, various activities are identified that structure the interaction between the work teams. Some activities add value to the project, while others do not. These activities are grouped into three main subcategories: (a) productive activities, (b) contributory activities, and (c) non-contributory activities. This classification allows design teams to have a clearer and more efficient view of maximizing the value generated by prioritizing the most relevant activities during this critical phase of the project. From the literature review, 31 activities were initially identified, which were reduced to 16 through homologation. These activities were validated and categorized according to experts' opinions obtained through interviews conducted within the framework of this study (Table 1).

## IDENTIFICATION OF MANAGEMENT PRACTICES IN THE DESIGN PHASE.

During the literature review, 61 collaborative management practices were identified and reduced to 25 through a homologation exercise. They were then assigned to the six categories specified in the second stage of the research method. This categorization helps organize the practices and identifies key areas where significant improvements can be made.

### Identification of practices associated with stakeholder management

Table 2 summarizes the main management practices in the stakeholder management literature. Stakeholder management is essential for success and focuses on identifying and managing the desires of all individuals interested in the project. During interviews with experts, they highlighted that poor management of practices associated with this category would negatively impact overall project costs and schedule. Thus, not involving clients or stakeholders in the design from the early stages of the project may result in a design that does not meet functional or regulatory requirements.

**Identification of Practices Associated with Project Planning and Control**

Table 3 summarizes the main management practices in project planning and control literature. This practice focuses on defining scopes, scheduling activities and processes, and continuously monitoring progress. Planning and control are fundamental in these projects where costs and deadlines are critical. Experts mentioned that collaborative project planning is key to improving coordination between design teams and their performance. However, the effectiveness of this practice often changes because, this planning does not include all relevant stakeholders.

**Identification of Practices Associated with Problem-Solving and Decision-Making.**

Table 4 summarizes the main management practices in problem-solving and decision-making literature. This practice focuses on identifying problems, evaluating alternatives, and making informed decisions that facilitate resolving conflicts and achieving objectives. High-rise building projects often have multiple problems due to their complexity that require effective decision-making. The experts emphasized that by applying these practices, diverse perspectives are integrated, ensuring optimal solutions are accepted by all involved. However, clear communication is needed for these practices to be effective, avoiding conflicts that slow down decision-making and the application of these practices.

**Identification of Practices Associated with Design Development**

Table 5 summarizes the main management practices found in the design development literature. This classification of practices focuses on conceptualizing, creating, and refining designs that meet client requirements and project specifications. The practices associated with this category seek to optimize the project design process and its constructive feasibility. In this type of project, where technical and regulatory requirements are demanding, one aspect highlighted by experts is the need to verify solutions and document results to foster collaboration between the different disciplines and thus reduce errors or rework, which usually originate from faults in the early stages of the design.

**Identification of Practices of Innovation and Continuous Improvement**

Table 6 summarizes the main management practices in innovation and continuous improvement literature. This category focuses on constantly searching for new ideas and implementing improvements that generate value and maintain competitiveness. The practices in this category aim to identify areas for design optimization. Experts highlighted that applying and monitoring solutions are closely linked to verifying and documenting results in the design development category. Reporting results after implementation ensures their effectiveness and strengthens the connection between these practices.

**Identification of Practices Associated with Motivation and Team Building**

Motivation and team management are essential to ensure design teams work together with commitment. This category fosters motivation, team building, and creating a positive and productive work environment (see Table 7). Experts emphasized the importance of motivating design teams for optimal performance, noting that this is often overlooked in favor of technical aspects. They highlighted the value of fostering collaborative spaces, which enhance creativity and problem-solving but require skilled leadership to manage conflicts and maintain team motivation. The Motivation and Team category underscores the need for a positive work environment to boost productivity and problem-solving.

**Table 1:** Practices Associated with Stakeholder Management

| Type | Activity | Source |
|---|---|---|
| Productive activities | Defining the scope, specifications, and limits of the project (PA1) | (Orihuela et al., 2015), |
| | Producing and communicating documentation to facilitate collaboration ($PA_2$) | Fallon & Palmer, 2006; O'Connor & Koo, 2021; Tan et al., 2018) |
| | identify customer requirements to understand customer needs ($PA_3$) | (Orihuela et al., 2015) |
| | Review constructability to assess project feasibility and efficiency ($PA_4$) | (Raouf & Al-Ghamdi, 2021) |
| | Provide feedback to all stakeholders to keep them informed of progress ($PA_5$) | (Orihuela et al., 2015; Tan et al., 2018) |
| | Perform cost analysis and estimation ($PA_6$) | (Orihuela et al., 2015) |
| | Validate the design to ensure its quality ($PA_7$) | (Badran et al., 2020; Han et al., 2007; O'Connor & Koo, 2021; Pikas et al., 2017) |
| Contributory activities | Monitor and control the design to ensure progress ($CA_1$) | (Bizarro et al., 2023; Fallon & Palmer, 2006; Freire & Alarcón, 2000; Tan et al., 2018) |
| | Identify and evaluate risks (CA2), | (O'Connor & Koo, 2021) |
| | Planning and scheduling of project activities to optimize resources and time ($CA_3$), | (Fallon & Palmer, 2006; Freire & Alarcón, 2000) |
| | Manage information requests for the resolution of concerns ($CA_4$) | (Fallon & Palmer, 2006; Freire & Alarcón, 2000) |
| | Make changes and rework for error correction or requirements adjustments (major adjustments) ($CA_5$) | (Bizarro et al., 2023; Freire & Alarcón, 2000; Orihuela et al., 2015; Tan et al., 2018; Zhao & Chua, 2003) |
| | Establishing quality and sustainability requirements to ensure compliance with standards ($CA_6$) | (Raouf & Al-Ghamdi, 2021) |
| Non-contributory activities | Leisure activities ($NCA_1$) | (Zhao & Chua, 2003) |
| | Waiting for inventory, information and/or documentation ($NCA_2$) | (Bizarro et al., 2023; Emuze et al., 2014; Zhao & Chua, 2003) |
| | Perform changes and rework for error correction or requirements adjustments (minor adjustments) ($NCA_3$), | (Badran et al., 2020; Freire & Alarcón, 2000; Orihuela et al., 2015; Tan et al., 2018; Zhao & Chua, 2003) |

**Table 2:** Practices Associated with Stakeholder Management

| ID* | Practices | Description |
|---|---|---|
| $SM_1$ | Identify and Manage Stakeholder Requirements | It involves understanding and managing the needs and expectations of all project stakeholders to ensure alignment and satisfaction |
| $SM_2$ | Encourage Client Participation in the Design. | It involves actively engaging clients during the design process to ensure the final product meets their needs and expectation |
| $SM_3$ | Promote Early Stakeholder Involvement and Collaboration in the Design. | It involves including key stakeholders from the early stages of design to identify critical requirements and facilitate effective collaboration |
| $SM_4$ | Maintain Long-Term Relationships with Suppliers. | It involves developing long-term strategic relationships with suppliers to enhance quality, innovation, and efficiency in the supply chain. |

$SM_1$. (El. Reifi & Emmitt, 2013; Herrera et al., 2020, 2021; Tommelein & Ballard, 2016; Woo Lee, 2012), $SM_2$. (El. Reifi & Emmitt, 2013; Herrera et al., 2020; Macomber et al., 2007), $SM_3$.(Ballard & Reiser, 2004; Herrera et al., 2020, 2021; Marius et al., 2021; Salgin et al., 2016), $SM_4$. (Ballard & Reiser, 2004)

**Table 3:** Practices Associated with Project Planning and Control.

| ID* | Practices | Description |
|---|---|---|
| $PC_1$ | Support Continuous Monitoring of Issues and Indicators | It involves establishing systems and procedures to continuously monitor issues and key performance indicators within a project |
| $PC_2$ | Develop the Design with a Detailed Estimate | It involves progressively developing the design while incorporating increasingly detailed estimates of resources, time, and costs and acknowledging and managing uncertainty throughout the process. |
| $PC_3$ | Maximize Project Value and Optimize Resources | It involves ensuring the greatest project benefit by efficiently using available resources to reduce costs and increase productivity without compromising quality |
| $PC_4$ | Organize and Communicate Project Information | It involves organizing and communicating relevant project information to all stakeholders |
| $PC_5$ | Plan the Project Gradually | It involves developing the project in stages and planning each phase step by step |
| $PC_6$ | Plan the Project Collaboratively | It involves engaging all team members in the planning process. |

*$PC_1$. (Alves et al., 2017; Silveira & Alves, 2018), $PC_2$. (Macomber et al., 2007; Woo Lee, 2012), $PC_3$. (Macomber, 2004), $PC_4$ and $PC_5$ (Alves et al., 2017; Herrera et al., 2020, 2021; Silveira & Alves, 2018; Tommelein & Ballard, 2016), $PC_6$ (Ballard & Howell, 2003; Herrera et al., 2020, 2021; Marius et al., 2021; Musa & Pasquire, 2020; Woo Lee, 2012; Zimina et al., 2012)

**Table 4:** Practices Associated with Problem-Solving and Decision-Making.

| ID | Practices | Description |
|---|---|---|
| $DM_1$ | Solve Problems Collaboratively | It involves identifying, analyzing, and solving problems jointly |
| $DM_2$ | Make Decisions Collaboratively | It involves making decisions based on relevant, accurate, and up-to-date information, with all key stakeholders involved in the decision-making |

*$DM_1$. (Ballard & Howell, 2003; El. Reifi & Emmitt, 2013; Herrera et al., 2020, 2021; Salgin et al., 2016), $DM_2$. (Ballard & Howell, 2003; El. Reifi & Emmitt, 2013; Herrera et al., 2020, 2021; Salgin et al., 2016)

**Table 5:** Practices Associated with Design Development.

| ID* | Practices | Description |
|---|---|---|
| $DD_1$ | Maintain Staff Continuity to Retain Knowledge | It involves retaining key personnel within the project to preserve critical knowledge about it. |
| $DD_2$ | Develop and Manage Design Requirements | It involves systematically identifying, defining, and managing the set of functional and technical requirements that the design must fulfill, ensuring traceability and alignment with project objectives throughout the design process. |
| $DD_3$ | Conduct Client-Oriented Design | It involves deeply understanding the client's needs and ensuring the end user's satisfaction. |
| $DD_4$ | Simultaneously Design the Product and Construction Process | It involves designing the product and the manufacturing process in an integrated |
| $DD_5$ | Collaboratively Identify and Document Constraints in the Design | It involves jointly identifying and documenting limitations or constraints that may affect the design. |
| $DD_6$ | Model Space Usage Before Designing | It involves conducting a detailed analysis and modeling how the space or product will be used under real conditions before starting the design |
| $DD_7$ | Verify Solutions and Document Results | It involves performing thorough tests, verifications, and documentation to ensure the proposed solutions meet all established requirements and specifications. |

*$DD_1$. (Zimina et al., 2012), $DD_2$. (Macomber et al., 2007; Musa & Pasquire, 2020; Silveira & Alves, 2018; Tommelein & Ballard, 2016), $DD_3$. (Ballard & Reiser, 2004; Macomber et al., 2007; Zimina et al., 2012), $DD_4$. (Ballard & Reiser, 2004; Herrera et al., 2020, 2021; Macomber et al., 2007; Salgin et al., 2016; Silveira & Alves, 2018), $DD_5$. (Ballard & Howell, 2003; Ballard & Reiser, 2004; Herrera et al., 2020, 2021), $DD_6$. (Macomber et al., 2007), $DD_7$. (Ballard & Reiser, 2004; Herrera et al., 2020, 2021; Macomber et al., 2007; Silveira & Alves, 2018; Zimina et al., 2012)

**Table 6:** Practices Associated with Innovation and Continuous Improvement.

| ID* | Practices | Description |
|---|---|---|
| $II_1$ | Identify Improvement Opportunities. | It involves identifying areas in current processes where changes can be made to increase efficiency or improve quality. |
| $II_2$ | Conduct Solution Research. | It involves researching and developing potential solutions for identified problems. |
| $II_3$ | Implement and Monitor Applied Solutions. | It involves implementing proposed solutions and monitoring their effectiveness. |

*$II_1$. (Macomber et al., 2007; Woo Lee, 2012; Zimina et al., 2012), $II_2$. (Zhang et al., 2020), $II_3$. (Macomber et al., 2007)

## PRACTICES AND ACTIVITIES RELATIONSHIP

Figure 1 illustrates the link between management practices and the activities identified. The graph's x-axis represents the management practices, while the y-axis shows the corresponding activities. In the linkage scheme, each practice is represented by a “+” when it contributes to increasing the frequency or encouraging the activity and by a “-” when it helps to decrease its frequency or mitigate it. Figure 1 shows how the management practices analyzed are related to the project activities, making it possible to prioritize those that have the most significant impact on project performance. The practices selected as most influential are those linked to five or more activities: $SM_1$, $SM_4$, $PC_3$, $PC_4$, $PC_6$, $DM_1$, $DD_4$, $DD_7$, $II_3$ and $MT_3$. Among these, $SM_4$ stands out as the most relevant, comprising 44% of the activities, followed by $SM_1$, $PC_6$, $DM_1$, $DD_7$, $II_3$ and $MT_3$, each with 38%, and finally $PC_3$, $PC_4$ and $DD_4$, with 31%. These practices are essential, since they promote activities that add value, and contribute to mitigating those that do not. Their impact on the optimization of design processes is significant, so they should be considered a priority in high-rise building projects. In addition, each category of practices contributes at least one practice to this list of the most influential, which reinforces the validity of the links established to address their importance in the design teams performance (Table 8).

**Table 7:** Practices Associated with Motivation and Team Building.

| ID* | Practices | Description |
|---|---|---|
| $MT_1$ | Generate Monetary and Non-Monetary Incentives. | It involves providing financial incentives such as bonuses or salary increases, and non-financial incentives such as recognition, professional development, or workplace flexibility to enhance performance and commitment |
| $MT_2$ | Create Collaborative Spaces in Terms of Physical and Technological Infrastructure. | It involves creating suitable work environments and utilizing technological tools to facilitate collaboration |
| $MT_3$ | Foster Collaborative Spaces in Terms of Human Relationships. | It involves fostering a work environment with open communication, trust, and mutual respect |

*$MT_1$. (Zimina et al., 2012), $MT_2$. (Ballard & Reiser, 2004; Macomber et al., 2007; Musa & Pasquire, 2020), $MT_3$. (Ballard & Reiser, 2004; Macomber, 2004; Macomber et al., 2007; Zimina et al., 2012)

Influential practices are obtained in all the proposed categories, which shows that the categories cover essential aspects of collaborative project management, allowing a comprehensive and balanced analysis of the most influential practices. By covering all the categories, the selected practices are more versatile, as they can be applicable to different types of projects, varying their relevance and impact according to the context. The identification of the most influential practices provides a strategic foundation for improving design management in high-rise building projects. Their implementation can support better coordination, communication, and efficiency across multidisciplinary teams. However, their effectiveness may depend on organizational culture, project scale, and stakeholder engagement. It is essential for practitioners to adapt these practices to their specific context and monitor their impact over time. A limitation of this study is the reliance on expert judgment and perceptions rather than empirical observation in ongoing projects. This may introduce subjective bias or limit generalizability. Nonetheless, the findings offer a robust starting point for future implementation and validation studies.

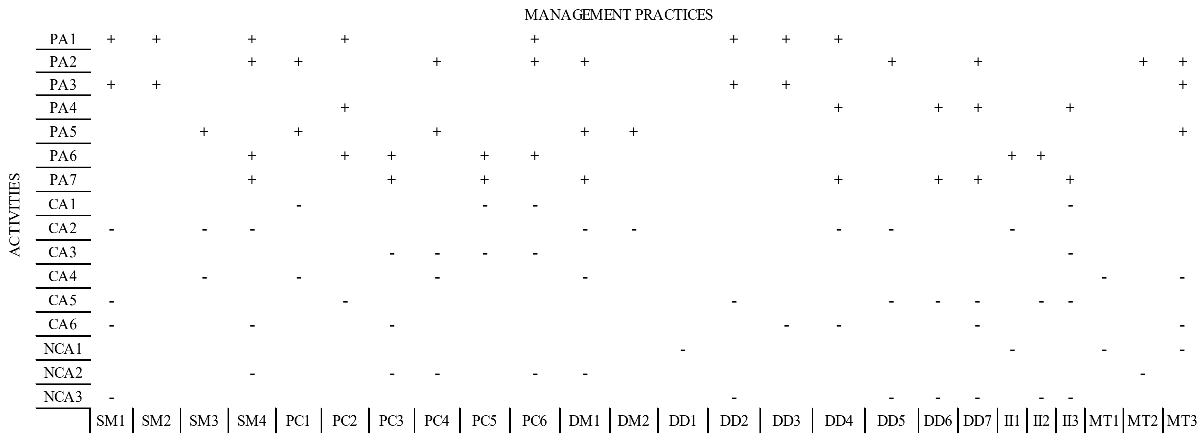


**Figure 1:** Connection between management practices and activities.

## VALIDATION OF PRACTICES AND ACTIVITIES RELATIONSHIPS

A survey of 49 professionals assessed knowledge of 15 collaborative management practices in high-rise building design. Results showed 87% of practices were rated at an advanced knowledge level, reflecting alignment with the practical experience of coordinators and planners frequently involved in management practices. However, practice SM1 had 20% of responses indicating it was "Completely unknown," highlighting a gap in dissemination and understanding. Categories such as Project Planning and Control, Problem-Solving and Decision-Making, and Innovation and Continuous Improvement had the highest advanced knowledge levels, with practices PC4, PC6, DM1, and II3 standing out due to over 60% of responses indicating expert knowledge. These widely known and implemented practices positively impact team performance, collaboration, and project outcomes. A survey with 33 professionals, primarily from Chilean projects, evaluated the impact of proposed management practices. Most responses fell in the “Optimal improvement” category, indicating the practices effectively enhance design and project performance. However, the lesser presence of the “Significant improvement” category suggests room for further optimization. Practices SM2, DD4, and II3 received minimal “No improvement” responses, warranting analysis of their implementation and impact. In contrast, practices PC2, PC3, PC6, DM1, and MT3 stood out, with over 42% of responses in the “Significant improvement” category, highlighting their strategic importance in enhancing design team performance and project effectiveness.

**Table 8:** List of most influential practices

| ID | Practice |
|---|---|
| $SM_1$ | Identify and manage stakeholder requirements |
| $SM_2$ | Encourage customer participation in design |
| $SM_4$ | Maintain long-term relationships with suppliers |
| $PC_1$ | Support continuous tracking of issues and indicators |
| $PC_2$ | Elaborate the design with detailed estimation |
| $PC_3$ | Maximize project value and optimize resources |
| $PC_4$ | Organize and communicate project information |
| $PC_5$ | Plan the project incrementally |
| $PC_6$ | Plan the project collaboratively |
| $DM_1$ | Solve problems collaboratively |
| $DD_4$ | Perform product design and construction process design simultaneously |
| $DD_7$ | Verify solutions and document results |
| $II_3$ | Apply and follow up implemented solutions |
| $MT_1$ | Generate monetary and non-monetary incentives |
| $MT_3$ | Generate collaborative spaces in terms of human relations |

The survey results highlight that the category “Significantly fosters collaboration” predominates, indicating that practitioners view the proposed practices as effective tools for enhancing collaboration between design teams and stakeholders. Practices PC3, PC4, PC6, DM1, and MT3 stood out, with PC3 and MT3 receiving the highest ratings in both collaboration and applicability. PC3 motivates teams by linking performance to rewards, while MT3 enhances communication and idea exchange among team members. Regarding applicability, most practices were rated as “Accessible to implement,” showing they are generally feasible for current projects. However, practice MT1 received a rating of “Impossible to implement” in specific contexts, such as small projects with limited budgets or teams, though it remains viable for larger projects. A validation matrix averaged the ratings for each criterion, supporting these findings. The practices with the highest scores, considered those with the highest degree of improvement, should be prioritized in the design processes of high-rise building projects, which belong to the categories of Stakeholder Management, Project Planning and Control, Design Development, and Innovation and Continuous Improvement.

# CONCLUSIONS

The design phase of high-rise building projects represents a significant challenge for professionals due to its complexity and the need for effective coordination between disciplines. This research identified 15 key activities and 61 relevant management practices, of which 15 were selected as the most influential in fostering collaborative management. These practices were evaluated through questionnaires applied to industry professionals to determine their impact on the performance of design teams. As a result, a ranking was established that prioritizes the practices according to their degree of improvement to performance, highlighting in decreasing order: PC6, SM4, II3, DD7, PC4, SM1, PC3, DD4, PC5, and PC2. Tools such as influence evaluation scales, linkage diagrams, and graphs were used to facilitate the organization and representation of the proposed practices. These tools made it possible to visualize the relationships between activities and practices and prioritize those with the greatest potential impact. The identified practices were integrated to demonstrate their potential to optimize productivity, coordination, and team collaboration, contributing to the project's success. Additionally, it is important to recognize that, particularly in the context of design processes, the classification of activities as productive, contributory, or non-contributory is not fixed. Their categorization may vary depending on how they are executed and the conditions under which they occur, which reinforces the importance of context-sensitive evaluation and continuous improvement in design management. The practical contribution of this research is based on a set of collaborative management practices that optimize productivity, coordination, and communication between design teams in high-rise building projects. These practices address key issues in the design phase, improving the quality of the results and reducing errors. Practices such as PC6 and PC5 have the potential to enable collaborative and phased project planning, which may promote early alignment and reduce conflicts. SM4 and SM1 strengthen supplier and stakeholder management, ensuring stability and commitment throughout the project. II3 and DD7 facilitate the continuous monitoring and evaluation of the implemented solutions, ensuring their effectiveness. PC3 and PC2 optimize the use of resources through detailed estimates and by integrating costs into the design. Finally, DD4 and PC4 improve the connection between design and construction and ensure proper organization and documentation of information. These results provide engineers, architects, and project managers with a tangible framework for addressing the specific challenges of the design phase. Professionals can use these practices to better structure their processes, minimize risks, foster interdisciplinary collaboration, and ensure communication among project stakeholders. This research has some limitations that should be considered. The study was based on a small group of experts from a specific geographic region and sector, which could limit the generalizability of the findings. Also, the study does not include a practical implementation of the collaborative practices. In addition, although practitioners validated the practices based on their experience, their direct implementation in real projects was not performed, leaving the need for empirical studies open. Some practices may face application difficulties in smaller projects due to resource constraints, although they could be adapted to different contexts.

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