


## Effect of Construction Manager's Political Skills on Relationship between Quality Management Practices and Inter-Organizational Project Success

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### Abstract

This study aims to explore the impact of construction managers' political skills on the relationship between quality management practices and the success of inter-organizational construction projects in Pakistan. Objectively, it examines how project managers' political acumen influences the effectiveness of quality management strategies and, consequently, project success. Employing a survey-based methodology, the research encompasses a broad spectrum of professionals involved in various construction projects across Pakistan. Through this analysis, the study identifies key challenges to project success and assesses the correlation between managerial political skills and the effective implementation of quality management practices. The findings reveal a notable positive relationship between these elements, highlighting the critical role of skills such as communication, stakeholder management, and conflict resolution. Additionally, the research underscores the interconnected nature of managerial competencies and identifies key factors impacting project success through advanced statistical techniques like principal component analysis and median absolute deviation. Significantly, this research provides novel insights into the role of human factors in the Pakistani construction industry's project management, proposing actionable strategies for skill enhancement and offering a comprehensive overview of factors influencing project success. These findings not only show the current skills and practices landscape but also lay the groundwork for future research and strategy implementation to boost industry-wide success.

**Keywords:** Construction Project Management; Managerial Skills; Quality Management Practices; Inter-Organizational Collaboration; Pakistani Construction Industry.

### 1. Introduction

The construction industry, a critical sector of the global economy, encounters a myriad of challenges, particularly evident in inter-organizational projects. These projects are complex due to the involvement of multiple stakeholders, varying objectives, and diverse operational environments [1–3]. The success of such projects is not merely contingent on efficient quality management practices but also significantly hinges on the nuanced role of project managers, especially in their political acumen [4–8]. Political skills in project management encompass the ability to navigate complex social networks, influence stakeholders, negotiate effectively, and achieve consensus among diverse groups, thus ensuring project alignment and success. In the context of Pakistan's construction sector, these aspects become even more pertinent. Pakistan's construction industry, while rapidly growing, is often confronted with unique challenges due to its cultural, economic, and political landscape [9–11]. This environment requires a distinct set of managerial skills and approaches. In general, the Pakistani construction industry, characterized by its diversity in terms of project scope,

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stakeholder complexity, and regional variations, provides fertile ground for exploring how the political skills of project managers can shape project outcomes [12]. This setting offers a unique opportunity to study the impact of soft skills, such as political acumen, on managing complex construction projects. The importance of managerial competencies in navigating these complexities is well documented. Studies by Ahmed et al. [13] and Choudhry & Zahoor [14] have highlighted various facets of project management in the context of Pakistani construction projects. These studies underline the crucial role of managerial competencies, such as leadership, communication, and strategic thinking, in managing the complexities inherent in construction projects. Building upon such foundational work, this research aims to add a new dimension by focusing specifically on the political skills of project managers. These skills, often underplayed in the technically dominant construction sector, are crucial for the successful navigation of the intricate web of stakeholder relationships and organizational dynamics [15–17].

The ability of project managers to tactfully manage and influence diverse groups, negotiate conflicts, and foster collaborative environments is vital for project success [18, 19]. This aspect is supported by studies like those of Braun & Sydow [2], who emphasize the importance of inter-organizational relationships in project management. The research by Badi & Diamantidou [20] and Lu et al. [21] further sheds light on the social and relational aspects that significantly impact project outcomes. These studies collectively underscore the need for project managers to possess advanced political skills that go beyond traditional project management competencies. The Pakistani construction industry, with its unique cultural and operational characteristics, presents specific challenges and opportunities in this regard. The studies by Ejaz et al. [10, 22] and Haseeb et al. [23] provide insights into the local industry's nuances, highlighting the need for tailored managerial approaches that consider cultural sensitivities and local business practices. This research extends these findings by focusing on the role of political skills, an area that has received limited attention in the context of the Pakistani construction sector. The methodology of this study, rooted in a survey-based approach targeting professionals across various construction projects in Pakistan, is designed to unravel the complex interplay between project managers' political skills, quality management practices, and project success. This approach aligns with the work of scholars like Laan et al. [24] and Loosemore & Lim [25], who have utilized similar methodologies to explore inter-organizational dynamics in the construction industry. By adopting a survey-based approach, this study seeks to gather empirical data that can provide insights into the real-world implications of political skills in project management.

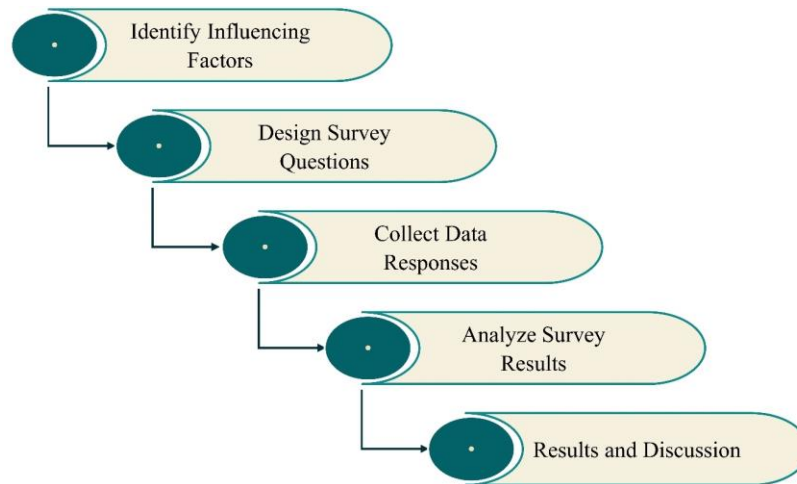
Moreover, this research is set against the backdrop of a global construction landscape that is increasingly recognizing the importance of human factors in project management. The works of Gambatese & Hallowell [26] and Gluch et al. [27] underscore the significance of innovative approaches and human-centric strategies in construction management. These studies highlight the evolving nature of the construction industry, where technical skills are no longer sufficient and the ability to manage people and relationships is becoming increasingly critical. By focusing on the Pakistani context, this study aims to contribute to this growing body of knowledge, offering insights that are both locally relevant and internationally applicable. The unique cultural, economic, and operational characteristics of Pakistan's construction industry provide an excellent case study for understanding how political skills can influence project management practices and outcomes. Additionally, this research seeks to bridge a gap in the existing literature by examining how the political skills of project managers can moderate the relationship between quality management practices and the success of inter-organizational projects in the construction industry. This aspect is particularly important given the increasing complexity and interconnectivity of modern construction projects, which require a more nuanced and sophisticated approach to management. The study aims to highlight the specific political skills that are most beneficial in the Pakistani construction context and propose a set of best practices for project managers to cultivate these skills. By doing so, this research not only adds to the academic discourse on project management but also offers practical guidance for professionals in the field. The findings of this study have the potential to enhance the success of construction projects in Pakistan and beyond by providing insights into how project managers can effectively navigate the complex web of relationships and challenges inherent in the construction industry.

## 2. Material and Methods

### 2.1. Research Strategy

As mentioned before, the success of projects depends significantly on the role of project managers, especially in their political acumen [28–32]. In this regard, the primary objective of this research is to explore the role of project managers' political skills in augmenting the effectiveness of quality management practices, subsequently impacting the success of inter-organizational construction projects in Pakistan. This aim emerges from a recognized gap in existing literature, where the specific influence of project managers' political acumen on project outcomes, particularly in the Pakistani construction industry, remains underexplored. In order to address this gap, the research adopts a comprehensive survey-based approach, targeting a wide spectrum of professionals involved in various construction projects across Pakistan. This strategy involves the development and distribution of a structured questionnaire designed to capture insights into the participants' perceptions of the role of political skills in project management. The survey responses are then analyzed using statistical methods to discern patterns and correlations between the project managers' political skills, quality management practices, and project success. All analyses were performed in Python for the simplicity of handling data.

This rigorous, step-by-step methodology ensures a robust exploration of the research point to contribute meaningful insights to both academicians and professionals involved in construction project management. Figure 1 shows a flowchart of the research methodology used in this study.



**Figure 1. Research methodology flowchart**

## 2.2. Rationale for Selecting a Survey Method

The decision to utilize a survey method in this research is grounded in a comprehensive rationale that aligns with the study's objectives to explore the intricate dynamics of the political skills of project managers in Pakistan's construction industry. Surveys, as a research tool, offer several advantages that make them particularly suited for this study. One of the primary reasons for choosing a survey method is its ability to reach a broad and diverse participant base across various regions and sectors within the construction industry. This wide coverage is crucial in capturing a representative sample of opinions and experiences, enabling the research to encompass a range of perspectives that reflect the multifaceted nature of the construction sector in Pakistan. The ability to engage participants from different geographical locations, project types, and managerial levels ensures that the findings are not limited to a narrow scope but rather provide a holistic view of the industry. Another key advantage of surveys is their structured format, which allows for the collection of quantitative data that is both reliable and consistent. This structured mechanism ensures that each participant responds to the same set of questions, facilitating comparability and consistency in the data collected. Such standardization is essential in a study like this, where the aim is to understand patterns and trends across various dimensions of project management, including the role of political skills in influencing project outcomes.

Furthermore, the survey method is particularly effective in exploring the relationship between quality management practices and project success, as influenced by managerial political skills. By employing a set of carefully designed questions, the survey can delve into specific areas such as conflict resolution, stakeholder management, and strategic planning, providing insights into how these skills are perceived and applied in the context of the Pakistani construction industry. This focus on specific competencies allows for a more detailed and nuanced understanding of the skills that are most critical for project success. Additionally, the flexibility and scalability of surveys make them an ideal choice for this research. Surveys can be easily adapted to cater to different respondent groups and can be scaled to include a large number of participants. This flexibility is particularly beneficial in a dynamic industry like construction, where professionals may have varying levels of experience and expertise. The ability to tailor the survey to different groups ensures that the research captures a comprehensive range of insights, encompassing the views of both seasoned professionals and those newer to the field. Moreover, the survey method allows for the analysis of patterns and correlations across different project settings and managerial roles. By collecting data on various aspects of project management and political skills, the survey can identify trends and relationships that might not be apparent through other research methods. For example, the survey can reveal how the importance of certain political skills may vary depending on project size, complexity, or the nature of stakeholder relationships. Thus, the survey method offers a systematic and efficient way to gather valuable data that can inform the development of strategies and best practices in the construction industry. Its ability to provide detailed insights into the perceptions and experiences of a wide range of industry professionals makes it an invaluable tool in this research, enabling a deeper understanding of the critical role that political skills play in the management and success of construction projects in Pakistan.

## 2.3. Target Audience

The survey was distributed to a wide range of professionals within Pakistan's construction industry, aiming to capture a wide range of perspectives and experiences. In total, 228 individuals participated, providing a robust dataset for

analysis. These participants represented a spectrum of roles, from on-site project managers and engineers to senior executives and quality assurance specialists, encompassing various levels of experience and responsibility. This demographic diversity ensured that the insights gained were reflective of the industry's multifaceted nature. The respondents varied in their tenure, with some having just a few years of experience. In contrast, others possessed many years of expertise, offering a rich understanding of the industry's evolution and current practices. Additionally, the survey captured data from professionals working on different types of construction projects, including residential, commercial, and infrastructure developments, further enriching the dataset. This strategic selection of the target audience was crucial in providing a comprehensive understanding of the connection between project managers' political skills, quality management practices, and project success in Pakistan's construction industry.

## 2.4. Selected Survey Questions

The survey deployed in this research was meticulously designed to capture an all-encompassing understanding of the role of project managers' political skills in the construction industry. The questionnaire was formulated to delve into a wide array of themes pivotal to project management, with each question tailored to probe different facets of managerial competencies and their influence on the success of construction projects. The survey emphasized key areas such as communication skills, stakeholder management, and conflict resolution, reflecting the critical nature of interpersonal dynamics in effective project management. Questions related to these areas were intended to uncover the extent to which project managers are proficient in conveying project goals, balancing and understanding diverse stakeholder expectations, and resolving internal team conflicts. Such competencies are fundamental in ensuring project coherence and maintaining momentum, especially in the context of complex, multi-stakeholder environments typical of construction projects. Furthermore, the survey delved into adaptability and time management skills, probing into project managers' capacity to navigate changes in project scope and consistently adhere to project timelines. This focus is particularly pertinent given the dynamic nature of construction projects, where managers are often required to adapt to evolving circumstances and unforeseen challenges while still ensuring timely project completion.

Negotiation skills and the ability to navigate organizational politics were also significant points of investigation. These areas are essential for strategic interactions with external entities and maneuvering within the internal bureaucracy of organizations. The survey questions in these areas aimed to assess how effectively project managers handle negotiations and political dynamics, which are often crucial in advancing project interests and overcoming administrative hurdles. In addition to these competencies, the survey incorporated questions on budgeting and quality management. This focus assessed the project managers' adeptness at maintaining high-quality standards amidst financial constraints and project limitations. It was essential to understand how project managers balance the often-competing priorities of cost control and quality assurance, which is a critical aspect of successful project management. The survey also probed into the softer aspects of project management, such as team collaboration, leadership, and motivation. Recognizing the importance of fostering a positive and productive team environment, questions were designed to evaluate how project managers cultivate teamwork, inspire and motivate their teams, and lead by example. These soft skills are as vital as technical expertise in ensuring team cohesion, motivation, and overall project success. Strategic planning, resource management, and risk management abilities were also key areas explored in the survey. These competencies are essential in project management, requiring foresight, effective optimization of resources, and comprehensive contingency planning. Questions in these areas aimed to ascertain how project managers anticipate future challenges, allocate resources efficiently, and mitigate risks proactively. The survey was structured to provide a panoramic view of the project manager's role in the construction industry, encompassing both hard and soft skills.

It was strategically designed to generate insightful data on how these varied competencies, particularly political skills, impact the overall success of construction projects. By probing into these diverse areas, the survey offered a thorough investigation into the intricate workings of project management within the construction industry. This comprehensive approach to survey design ensured that the research captured a holistic picture of the project manager's role. It was not just about understanding the technical aspects of project management but also about exploring the human element, which plays a significant role in the success of construction projects. The survey aimed to shed light on the complex interplay between various managerial skills and how they collectively contribute to project outcomes. This understanding is vital for developing effective strategies and interventions to enhance project management practices in the construction industry, particularly in the context of Pakistan's unique operational and cultural landscape. Hence, the survey was a crucial instrument in this study, designed to explore a range of competencies and skills that are essential for effective project management in the construction industry. Its comprehensive nature allowed for an in-depth analysis of the role of project managers, providing valuable insights into the factors that contribute to the success of construction projects. The findings from the survey are expected to have significant implications for both theory and practice in the field of construction project management.

**Table 1. Survey questions and their associated factors**

No.	Factors Considered	Question
1	Communication Skills	How effectively do project managers communicate project goals to the team?
2	Stakeholder Management	Rate the ability of project managers to understand and manage stakeholder expectations.
3	Conflict Resolution	Evaluate the project managers' skill in resolving conflicts within the team.
4	Adaptability	How well do project managers adapt to changes in project scope or environment?
5	Time Management	Assess the influence of project managers' political skills on project timeline adherence.
6	Negotiation Skills	Rate the effectiveness of project managers in negotiating with suppliers and contractors.
7	Navigating Organizational Politics	Evaluate how project managers deal with bureaucratic challenges in the organization.
8	Budgeting and Quality Management	How effective are project managers in maintaining quality standards under budget constraints?
9	Team Collaboration	Assess the project managers' ability to foster a collaborative team environment.
10	Strategic Planning	Rate the project managers' competence in strategic planning and foresight.
11	Resource Management	Evaluate the project managers' skills in leveraging resources for project success.
12	Risk Management	How effectively do project managers manage risks and uncertainties in projects?
13	Stakeholder Satisfaction	Assess the influence of project managers' political skills on stakeholder satisfaction.
14	Leadership and Motivation	Rate the ability of project managers to inspire and motivate the project team.
15	Cross-Cultural Communication	Evaluate the project managers' effectiveness in cross-cultural communication within the team.
16	Organizational Alignment	How well do project managers align project objectives with organizational goals?
17	Documentation and Reporting	Assess the project managers' proficiency in managing project documentation and reporting.
18	Quality Management Implementation	Rate the project managers' ability to implement and adhere to quality management practices.
19	Conflict Resolution effectiveness	Evaluate the impact of project managers' political skills on conflict resolution effectiveness.
20	Technology Utilization	How effectively do project managers utilize technology for project management?
21	Continuous Process Improvement	Assess the project managers' capability in continuous improvement of processes.
22	Environmental and Sustainability Management	Rate the project managers' skills in managing environmental and sustainability issues.
23	Legal and Regulatory Adaptability	Evaluate the adaptability of project managers to changing legal and regulatory environments.
24	Inter-Departmental Coordination	How well do project managers manage inter-departmental coordination for project success?
25	Crisis Management	Assess the project managers' effectiveness in crisis management.
26	Long-Term Strategic Thinking	Rate the project managers' ability in long-term strategic thinking and planning.
27	Stakeholder Engagement	Evaluate the project managers' skills in stakeholder engagement and communication.
28	Task Prioritization	How well do project managers prioritize and manage project tasks and deliverables?
29	Resource Allocation	Assess the project managers' ability to manage and allocate project resources efficiently.
30	Risk Identification and Mitigation	Rate the project managers' skills in identifying and mitigating project risks.
31	Scope Management	Evaluate the project managers' effectiveness in managing project scope and changes.
32	Safety Standards Promotion	How effectively do project managers promote and maintain safety standards on project sites?
33	Team Building	Assess the project managers' ability in building effective teams and promoting teamwork.
34	Innovation Promotion	Rate the project managers' skills in fostering innovation within the project team.
35	External Stakeholder Communication	Evaluate the project managers' effectiveness in communicating with external stakeholders.
36	Customer Needs Integration	How well do project managers understand and integrate customer needs into the project?
37	Time-Sensitive Management	Assess the project managers' capability in managing time-sensitive project aspects.
38	Quality Management Tools Application	Rate the project managers' effectiveness in applying quality management tools and techniques.
39	Cost Management	Evaluate the impact of project managers' political skills on project cost management.
40	Deliverables Management	How effectively do project managers manage project deliverables against set objectives?
41	Ethical Standards Maintenance	Assess the project managers' skills in maintaining ethical standards in project execution.
42	Expectation Management	Rate the project managers' ability to manage expectations and deliver project outcomes.
43	Continuous Learning	Evaluate the project managers' effectiveness in continuous learning and development.
44	Inter-Team Communication	How well do project managers facilitate communication between different project teams?
45	Handling Unexpected Events	Assess the project managers' capability in handling unexpected events and setbacks.
46	Project Management Methodologies Utilization	Rate the project managers' proficiency in utilizing project management methodologies.
47	Project Scope-Time-Cost Balance	Evaluate the project managers' effectiveness in balancing project scope, time, and cost.
48	Feedback Incorporation	How effectively do project managers incorporate feedback into project processes?
49	Enhancing Team Creativity	Assess the project managers' role in enhancing team creativity and problem-solving.
50	Overall Impact on Project Success	Rate the overall impact of project managers' political skills on the success of inter-organizational projects.



51	Compliance with Local Regulations	Evaluate the effectiveness of project managers in overseeing compliance with local construction codes and regulations.
52	Understanding of Civil Engineering Technologies	Rate the project managers' understanding of modern civil engineering technologies relevant to construction.
53	Ensuring Structural Integrity	Assess the role of project managers in ensuring the structural integrity of construction projects.
54	Subcontractor Management	How effectively do project managers manage subcontractor selection and oversight?
55	Sustainable Construction Practices	Evaluate the project managers' ability to apply sustainable construction practices.
56	Safety Measures in Construction	Rate the adequacy of safety measures implemented in construction projects under the managers' supervision.
57	Soil Analysis and Foundation Planning	Assess the project managers' competency in soil analysis and foundation planning.
58	Innovative Construction Techniques	Evaluate the effectiveness of project managers in implementing innovative construction techniques.
59	Environmental Impact Assessment	How well do project managers integrate environmental impact assessments into their planning?
60	Managing Projects in Challenging Terrains	Rate the project managers' ability to manage construction projects in challenging terrains or conditions.
61	Water Resource Management	Assess the project managers' proficiency in water resource management in construction projects.
62	Handling Logistical Challenges	Evaluate how project managers deal with logistical challenges in construction sites.
63	Quality of Construction Materials	Rate the project managers' capability in overseeing the quality of construction materials used.
64	Energy effectiveness Practices	How effectively do project managers incorporate energy-efficient practices in construction projects?
65	On-site Waste Management	Assess the project managers' role in facilitating effective on-site waste management.
66	Work-site Cleanliness and Organization	Evaluate the project managers' approach to maintaining work-site cleanliness and organization.
67	Zoning and Land-Use Planning	Rate the project managers' effectiveness in handling zoning and land-use planning issues.
68	Seismic Design Compliance	How well do project managers ensure compliance with seismic design requirements in construction?
69	Managing Large-Scale Civil Projects	Assess the project managers' capability in managing large-scale civil engineering projects.
70	Bridge and Infrastructure Construction	Evaluate the project managers' expertise in bridge and infrastructure construction and management.

### 3. Survey Analysis

#### 3.1. Reliability Assessment

The evaluation of data reliability is a critical aspect of this research, as addressed in this section through the computation of Cronbach's alpha. This statistic, illustrated in Figure 2, serves as an essential tool for determining the internal consistency and reliability of the survey responses. By implementing Cronbach's alpha, the study ensures the robustness and dependability of its findings, anchoring them in statistically verified grounds. Cronbach's alpha, widely recognized as a fundamental measure of scale reliability, yielded a notable high value of 0.947 for the combined factors. This value is significant as it indicates a robust level of internal consistency among the survey responses. It reveals that the different aspects and dimensions assessed in the survey are not only interconnected but also cohesively contribute to the broader constructs and themes explored in this study. Such coherence is crucial for validating the survey instrument, as it affirms that the various items are appropriately measuring the intended constructs without significant discrepancies or inconsistencies. The implications of this high Cronbach's alpha value are substantial. It underpins the reliability of the survey instrument, suggesting that the survey questions are well-designed and effectively capture the nuances of the subjects under investigation. This, in turn, lends considerable credibility to the subsequent analyses and conclusions drawn from the data. A high internal consistency as indicated by this value suggests that the survey responses are reliable and can be confidently used to make informed conclusions about the phenomena being studied. This level of reliability is essential in empirical research, as it ensures that the study's findings are based on a solid and trustworthy foundation, thereby enhancing the overall validity and impact of the research.

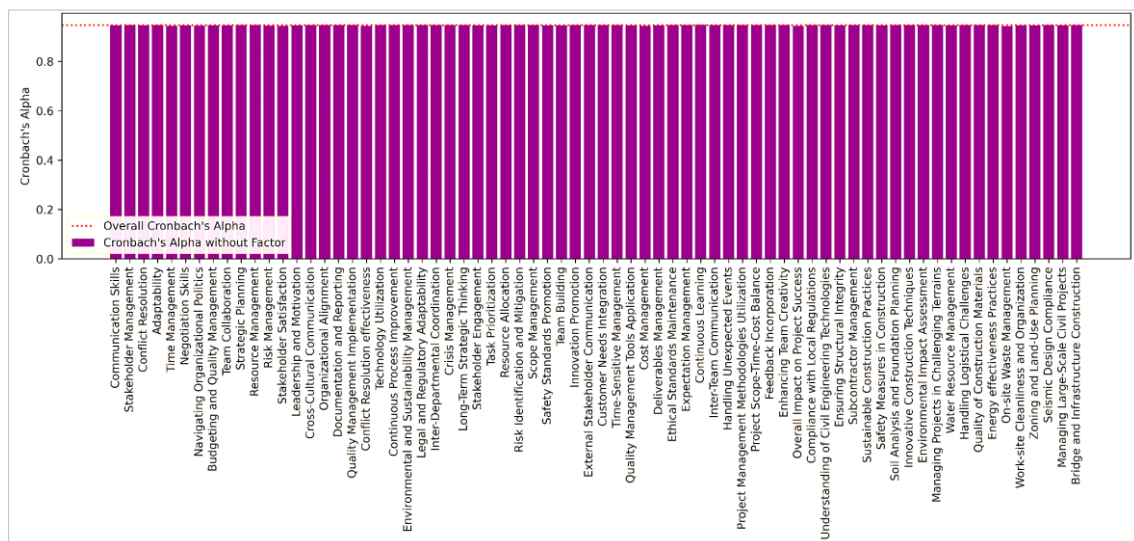


Figure 2. Visualization of Cronbach's alpha for the collected data

### 3.2. Statistical Overview

The comprehensive statistical analysis of the survey results, as depicted in Figures 3 to 5, provides an in-depth view of the current state of managerial skills and practices in the Pakistani construction industry. This section offers a detailed interpretation of these figures, emphasizing their implications for the study's objectives. Figure 3 presents the mean scores for each factor, offering valuable insights into the collective perceptions of industry professionals. Factors like Communication Skills, Stakeholder Management, and Conflict Resolution exhibit relatively high mean scores, suggesting a general consensus on their significance in project success. This indicates that professionals within the industry recognize the critical importance of these skills in managing construction projects effectively. The high scores in these areas reflect an awareness of the complexities involved in project management and the need for robust communication channels, effective stakeholder engagement, and efficient conflict resolution mechanisms. Conversely, areas like Adaptability and Time Management show slightly lower mean scores, suggesting a potential gap in these skills among project managers. This finding is crucial as it points to areas where project managers may require further training and development. The ability to adapt to changing project environments and effectively manage time are essential skills in the dynamic and often unpredictable landscape of construction projects. These lower scores may indicate a need for more focused attention on developing these competencies within the industry.

Figure 4, featuring a heatmap showing the frequency of chosen factors, provides an intuitive visual representation of areas where consensus is strongest among respondents. Darker shades in the heatmap indicate factors that are more uniformly agreed upon across participants. This visualization is particularly helpful in quickly identifying key areas of focus in the construction industry. For example, if Stakeholder Management consistently appears in darker shades, it underscores its perceived importance across a wide range of respondents, reinforcing the need for project managers to be skilled in this area. Figure 5, which presents the response distribution for individual factors, adds another layer of depth to our understanding. This figure breaks down the responses for each factor, revealing not only the mean scores but also the distribution of opinions among the participants. For instance, a factor like Navigating Organizational Politics might have a moderate mean score, but the distribution of responses could indicate a polarized view among respondents. Such insights are crucial for comprehending the nuances in perceptions and the varying degrees of emphasis placed on different managerial skills. Together, these statistical descriptors provide a comprehensive overview of the state of managerial skills and practices in the Pakistani construction industry.

The survey results reflect broad recognition of the importance of managerial skills, especially in areas such as stakeholder management and conflict resolution. This aligns well with the study's focus, suggesting that project managers' political skills are vital in enhancing the effectiveness of quality management practices. Further, the survey results shed light on specific political skills that are most beneficial in the Pakistani construction context. High scores in factors like Conflict Resolution and Navigating Organizational Politics indicate these as key skills for project managers in dealing with the complex dynamics of construction projects. Understanding these skills' importance can guide project managers in focusing their development efforts on areas that will most significantly impact project outcomes. The findings from this survey are instrumental in informing the development of a set of best practices for project managers in the construction industry, particularly in the context of Pakistan. By understanding the current state of skills and practices and identifying areas that need improvement, this research contributes valuable insights into the role of human factors in project management. The aim is to provide actionable strategies for enhancing project success through improved managerial competencies, with a particular focus on the unique challenges and cultural aspects of the Pakistani construction industry.

Moreover, the data underscores the need for continuous professional development and training for project managers. It highlights the dynamic nature of the construction industry, where ongoing learning and adaptation are essential for keeping pace with evolving project requirements and stakeholder expectations. The study's findings can be used to tailor training programs and professional development initiatives that address the specific needs and challenges identified in the survey. Accordingly, the statistical overview presented in Figures 3 to 5 offers a rich and nuanced understanding of the current landscape of managerial skills and practices in the Pakistani construction industry. The insights gleaned from this analysis are critical for shaping future strategies and interventions aimed at enhancing the effectiveness and success of construction projects. By delving into the specifics of these results, this research paves the way for a more informed and targeted approach to improving project management practices in Pakistan's construction sector.

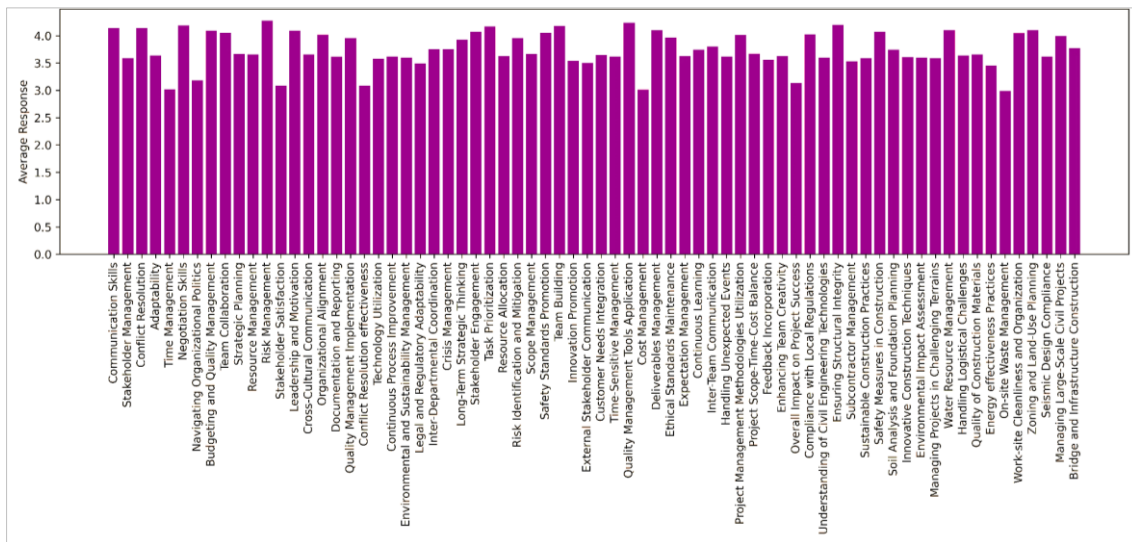


Figure 3. Mean scores for each factor



Figure 4. Heatmap showing frequency of the chosen factors



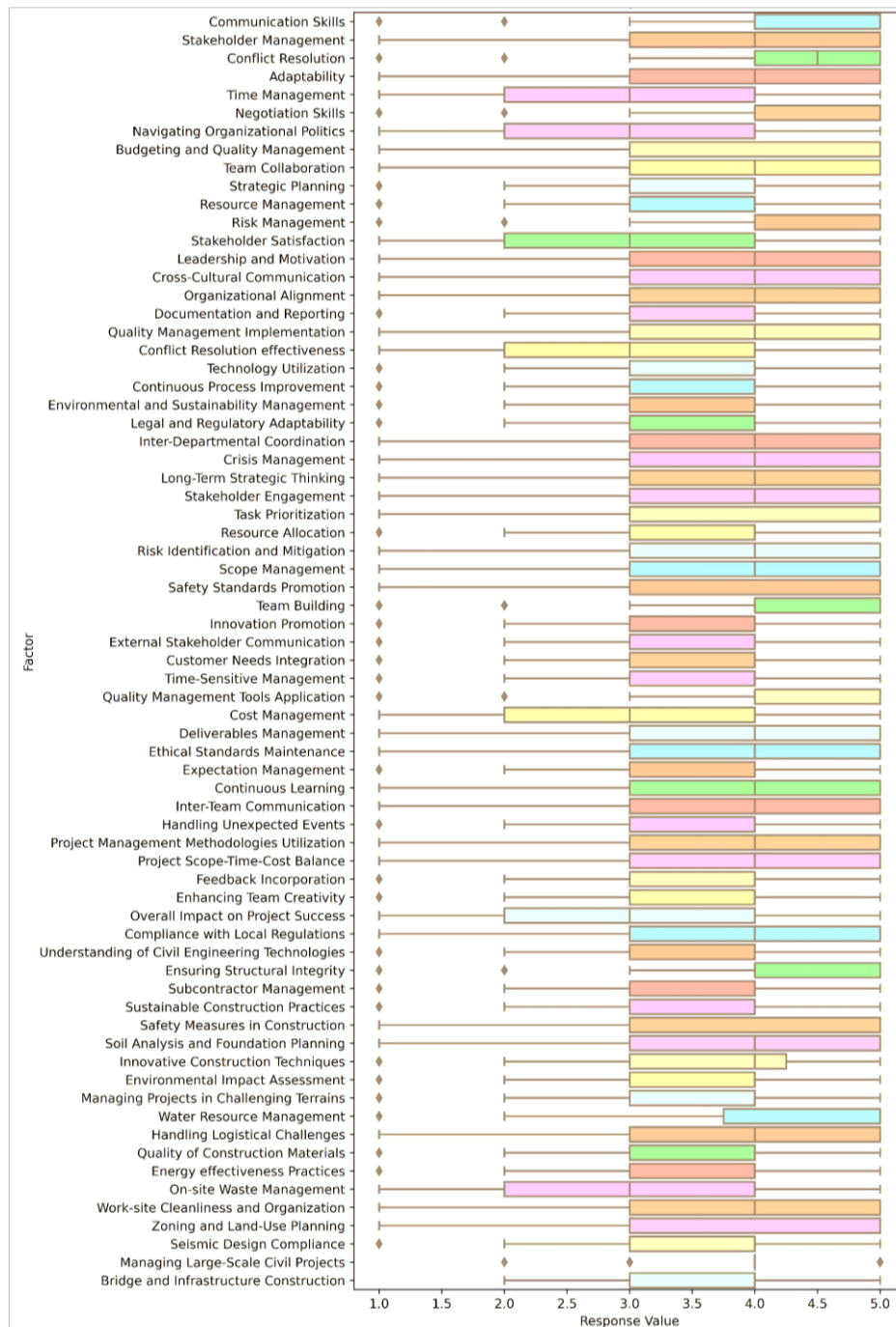


Figure 5. Response distribution for individual factor

### 3.3. Kruskal-Wallis Test

The Kruskal-Wallis test was applied in this study to discern whether the differences in responses across various factors are statistically significant. This is crucial in identifying which factors hold consistent perceptions across different demographic or professional groups within the survey population and which factors exhibit significant variances in opinion. The heatmap displayed in Figure 6 illustrates the p-values from the Kruskal-Wallis test comparisons. In this heatmap, each cell represents the p-value for the comparison of a particular factor across different groups. A lower p-value (typically less than 0.05) suggests that there is a statistically significant difference in the way different groups perceive or prioritize that factor. This is crucial in understanding how different aspects of project management and quality management practices are valued differently by various segments of professionals. For example, factors with low p-values imply that there is a significant difference in how these groups rate this factor. This could be indicative of differing priorities or varying levels of expertise in these areas among different groups of professionals.

Conversely, factors with high p-values suggest that there is a consensus across different groups regarding that factor. This is equally important as it highlights the areas where there is uniformity in understanding or valuing certain aspects of project management, regardless of the respondents' demographic or professional background. The results from the Kruskal-Wallis test provide an additional layer of insight into the data collected. By understanding not only what the

predominant views are but also how these views differ across various groups, it is possible to gain a better understanding of the dynamics at play in Pakistan's construction industry. This is particularly relevant in the context of your study, as it seeks to uncover the nuanced ways in which project managers' political skills can influence the effectiveness of quality management practices.

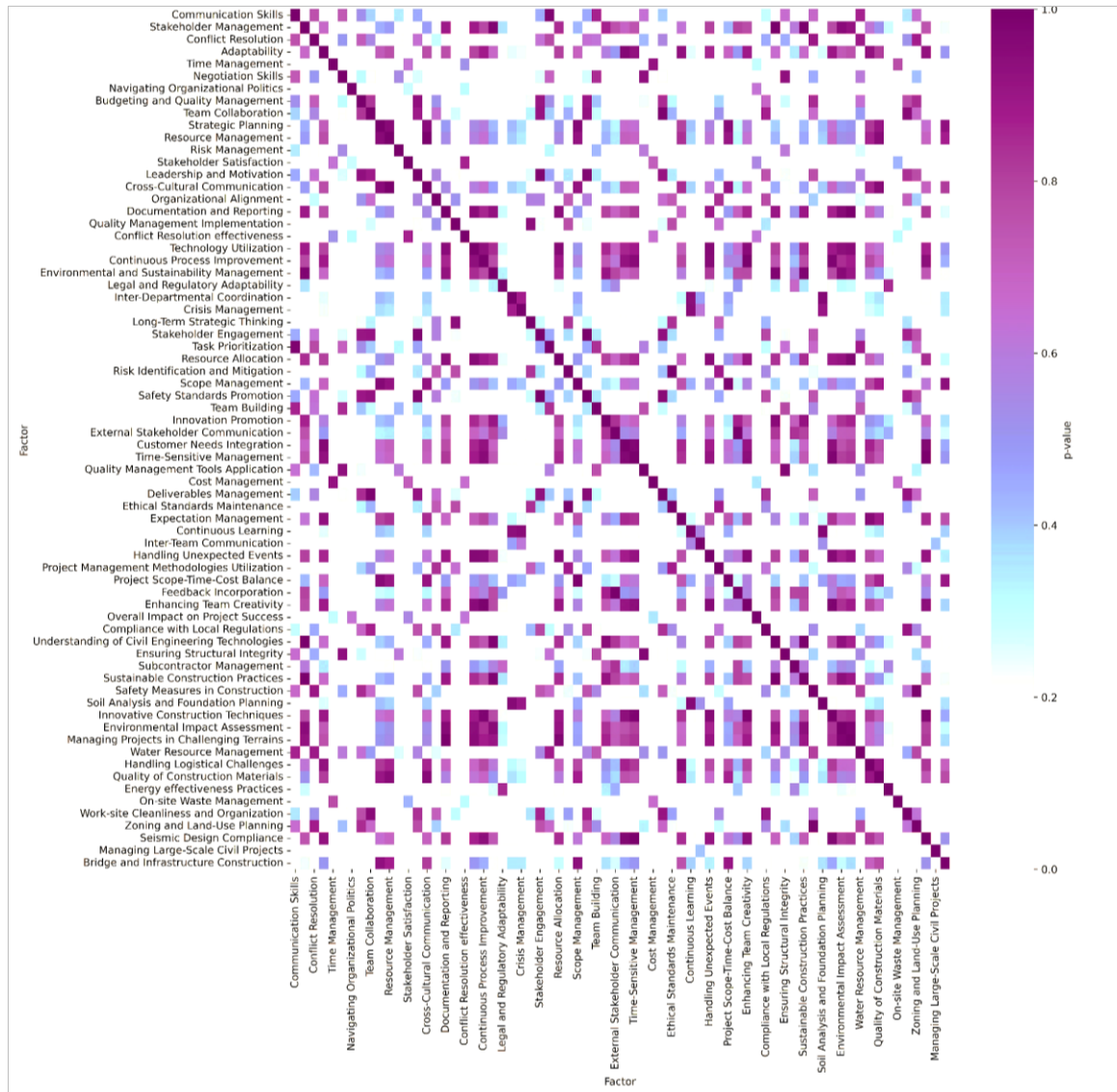


Figure 6. Heatmap displaying p-values from Kruskal-Wallis test comparisons

### 3.4. Correlation Analysis

The analysis in this section reveals intricate relationships between the survey's various factors. This analysis is pivotal in understanding the interconnections and independent natures of managerial and technical skills in the construction industry. For instance, the correlation between Conflict Resolution and Navigating Organizational Politics indicates a relatively significant positive relationship, suggesting that individuals proficient in conflict resolution are also likely to be adept at navigating organizational politics. Similarly, a notable positive correlation exists between "Team Collaboration" and "Negotiation Skills", illustrating that effective team collaboration often coincides with strong negotiation skills. On the other hand, some skills show a lower degree of correlation with others, such as Adaptability and Budgeting and Quality Management, indicating that these skill sets may operate independently within the professional sphere. Furthermore, the correlation between Stakeholder Management and Seismic Design Compliance implies that those who excel in stakeholder management also tend to prioritize seismic design compliance. These insights, visualized in Figure 7 as a comprehensive cross-comparison of responses, are instrumental in identifying the key skills that are interrelated and those that are distinct. Understanding these relationships is crucial for developing effective training programs for project managers, particularly in the context of the Pakistani construction industry. By focusing on enhancing interrelated skills, project managers can be better equipped to handle the complexities of inter-organizational construction projects. The correlation analysis thus contributes significantly to the overarching goal of the study, offering empirical evidence to support the development of targeted strategies to enhance project outcomes through improved managerial competencies.

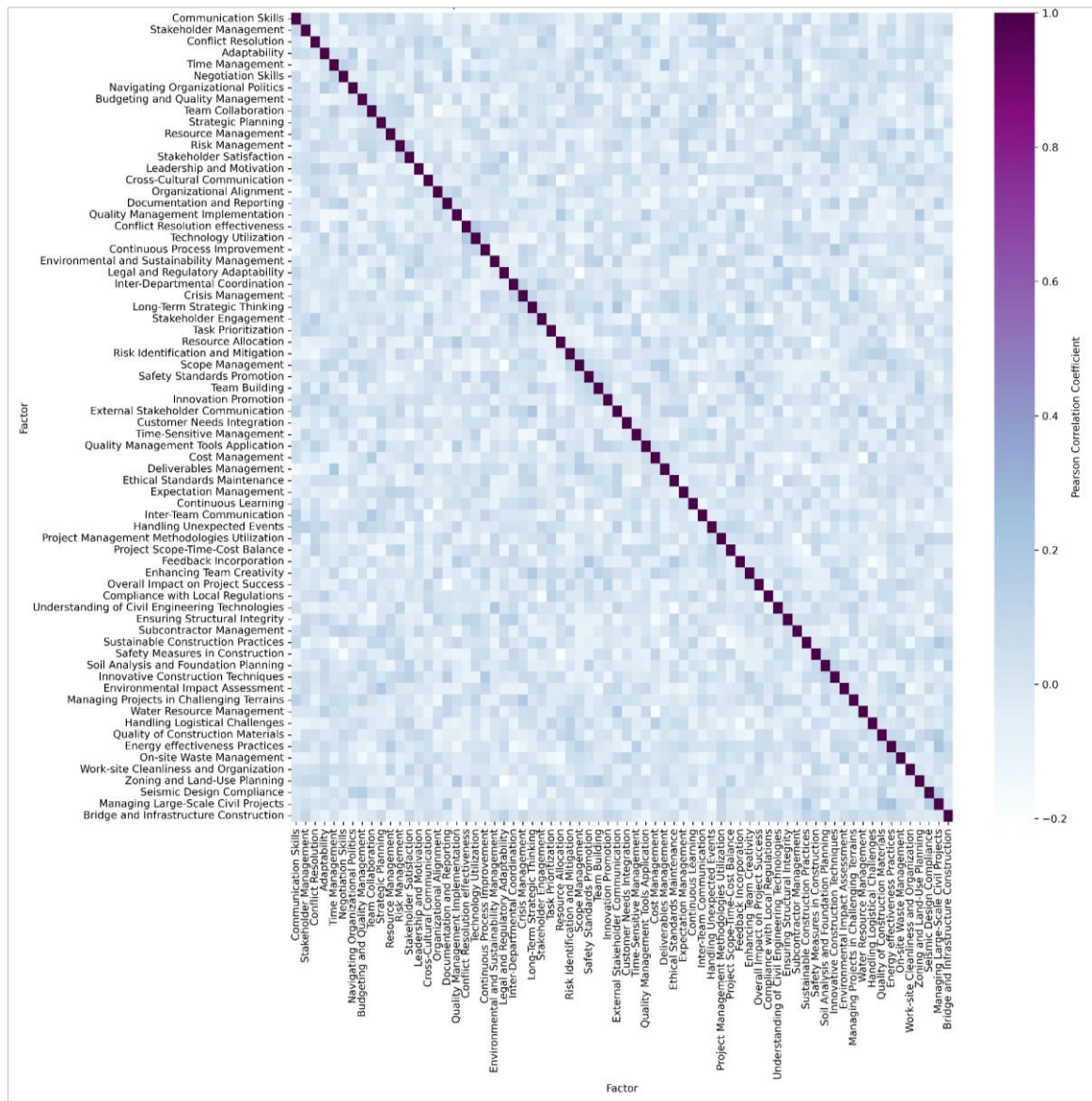


Figure 7. Cross-comparisons of the responses for the investigated factors

#### 4. Influential Factors

This section explores the use of principal component analysis (PCA) and median absolute deviation (MAD) methods to identify and analyze the most significant factors influencing the success of inter-organizational construction projects in Pakistan. These advanced statistical techniques offer a nuanced understanding of the multifaceted dynamics that drive project management in the construction industry. The PCA method is a sophisticated statistical technique that emphasizes variation and captures strong patterns in a dataset. By reducing the dimensionality of the data, PCA brings forth the most influential factors that account for the largest variance within the dataset. In this study, PCA identified ten pivotal factors: Conflict Resolution, Time Management, Team Collaboration, Technology Utilization, Crisis Management, Long-Term Strategic Thinking, External Stakeholder Communication, Time-Sensitive Management, Project Scope-Time-Cost Balance, and Zoning and Land Use Planning. Each of these factors plays a crucial role in encapsulating the variances within the dataset and highlights their critical role in project management.

For example, Conflict Resolution and Time Management are essential in managing disputes effectively and allocating time resources efficiently. Efficient conflict resolution ensures smooth project progression, while adept time management is key to meeting project deadlines and maintaining project momentum. Similarly, Crisis Management and External Stakeholder Communication are imperative for handling unexpected challenges and maintaining robust communication channels with various stakeholders, including clients, contractors, and government entities. The inclusion of Technology Utilization and Long-Term Strategic Thinking underscores the growing significance of integrating modern technologies and forward-looking strategies in construction project management. Embracing new technologies can lead to more efficient processes and innovative solutions, while strategic thinking ensures projects align with long-term objectives and market trends.



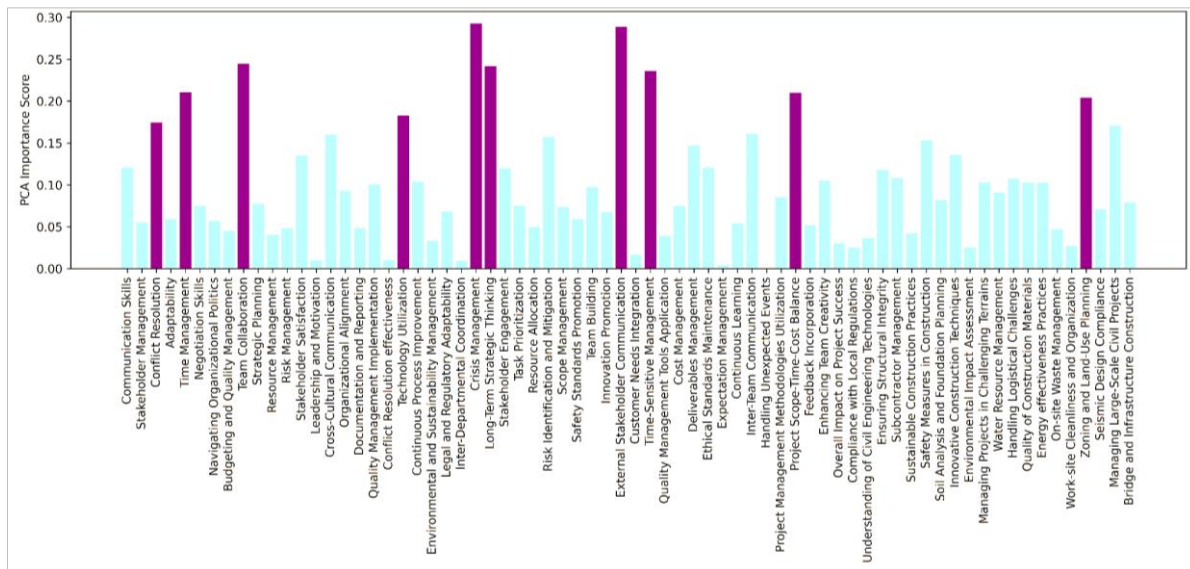


Figure 8. Ranking of factors in this research using the PCA method with the 10 most significant factors being highlighted

On the other hand, the MAD method focuses on variability and dispersion in the dataset, highlighting a distinct set of top factors. These include Stakeholder Management, Long-Term Strategic Thinking, Risk Identification and Mitigation, Safety Standard Promotion, Innovation Promotion, External Stakeholder Communication, Ethical Standard Maintenance, Safety Measures in Construction, Innovative Construction Techniques, and Energy Effectiveness Practices. This unique set of factors emphasizes the importance of managing stakeholder relationships effectively and promoting safety and innovation in the construction field. Stakeholder Management and Ethical Standard Maintenance, for instance, highlight the necessity of maintaining strong ethical standards and relationships with all stakeholders. This is crucial in a sector where multiple parties are involved, and trust and transparency are key to project success. Innovation Promotion and Innovative Construction Techniques reflect the industry's growing need to adopt new methods and technologies. These innovations not only enhance efficiency and sustainability but also position companies to be competitive in a rapidly evolving market. The results from both PCA and MAD methods, as illustrated in Figures 8 and 9, reveal the multifaceted and dynamic nature of project management in the construction industry. The interplay of technical skills, such as Innovative Construction Techniques and Energy Effectiveness Practices, with managerial and interpersonal skills, such as Stakeholder Management and External Stakeholder Communication, epitomizes the complex landscape of project management. This complexity is further accentuated by the need to balance project scope, time, and cost effectively, alongside navigating zoning and land use planning regulations. Understanding the significance of these factors is crucial for developing targeted strategies to enhance project outcomes. This is particularly relevant in the Pakistani construction industry, where specific cultural and organizational dynamics come into play. The industry's unique challenges, such as navigating local regulations, understanding cultural nuances, and dealing with diverse stakeholder groups, require a specialized approach to project management.

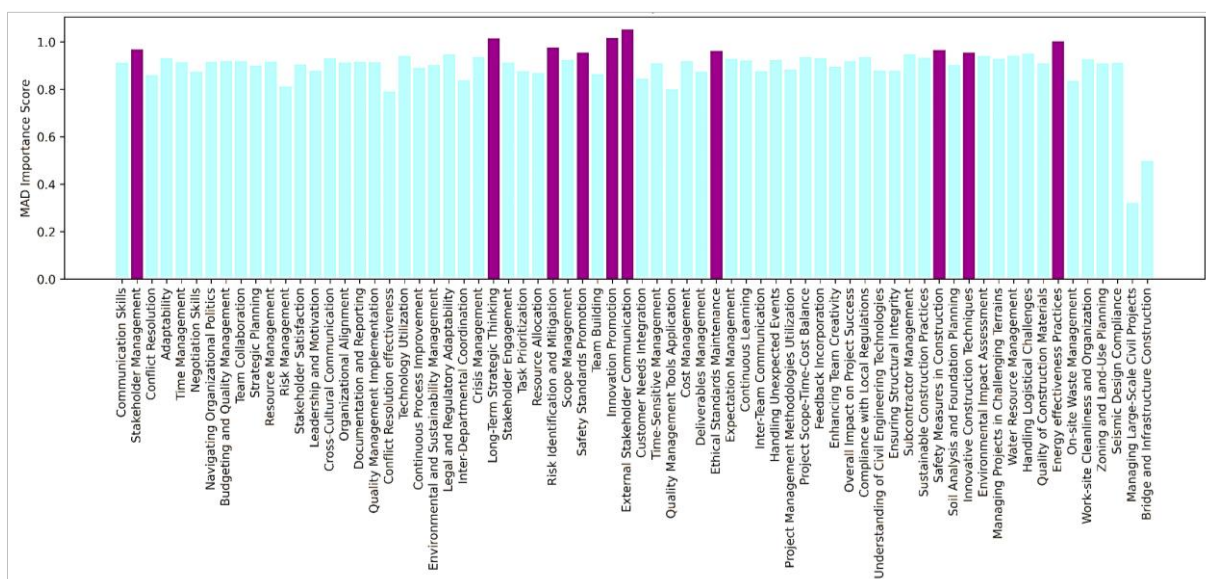


Figure 9. Ranking of factors in this research using the MAD method approach with the 10 most significant factors being highlighted



This comprehensive analysis significantly contributes to identifying and prioritizing the skills and practices most impactful in achieving inter-organizational project success. It provides valuable insights for project managers, policymakers, and industry stakeholders, enabling them to focus their efforts on developing and enhancing these key areas. By aligning managerial practices with these identified factors, the construction industry in Pakistan can improve project success rates, enhance efficiency, and foster sustainable growth. Furthermore, this research offers a foundation for future studies to build upon, encouraging a deeper exploration of how these factors can be optimized in different construction contexts. It also opens avenues for comparative studies across different regions and construction environments, fostering a global understanding of effective construction project management practices. In conclusion, this section's in-depth analysis not only enriches the academic discourse in construction project management but also provides practical guidance for industry practitioners, contributing to the advancement of the field.

## 5. Grouping of Factors Using K-means Clustering

This section groups the survey factors to uncover underlying themes within the context of project management in the construction industry. In this context, it integrates the results of K-means clustering, optimized through the elbow method, to identify five distinct clusters, each representing a unique thematic grouping of factors. In general, K-means clustering is a method used for partitioning a dataset into K distinct, non-overlapping subgroups where each data point belongs to only one group. In this regard, the elbow method, visualized in Figure 10, helped determine the optimal number of clusters, which was found to be five. This method involves plotting the explained variance against the number of clusters, and the 'elbow' represents the point after which the addition of another cluster does not give much better modeling of the data. The results of this analysis, as given in Figure 11 and Table 2, are as follows:

- Cluster 1, labeled as "*Project Management*," encompasses a comprehensive range of factors such as Conflict Resolution, Time Management, Budgeting and Quality Management, Strategic Planning, and various others like Innovative Construction Techniques and Managing Large-Scale Civil Projects. This cluster highlights the multifaceted nature of project management, emphasizing not only traditional aspects like budgeting and scheduling but also more dynamic elements such as innovation and sustainability. The inclusion of factors like External Stakeholder Communication and Subcontractor Management indicates the importance of external relations in project management, while Safety Standards Promotion and Sustainable Construction Practices underscore the growing focus on sustainable and safe construction practices.
- Cluster 2, themed "*Interpersonal Skills*," includes Adaptability, Negotiation Skills, Team Collaboration, and Risk Management, among others. This cluster underscores the significance of soft skills in the construction industry. The ability to adapt, collaborate effectively, and negotiate is crucial in navigating the complex interpersonal dynamics of construction projects. Risk Identification and Mitigation and Understanding of Civil Engineering Technologies in this cluster indicate that technical knowledge is also vital for effective interpersonal interactions.
- Cluster 3, "*Leadership and Strategy*," comprises Stakeholder Management, Resource Management, Leadership and Motivation, and several other factors. This cluster underscores the strategic aspect of project management, highlighting the need for strong leadership and resource management. The inclusion of factors like Crisis Management and Long-Term Strategic Thinking suggests the importance of foresight and the ability to handle unforeseen challenges. Ethical Standards Maintenance and Continuous Learning indicate a focus on ethical conduct and the importance of ongoing development in leadership roles.
- Cluster 4, "*Communication and Quality Control*," is composed of Communication Skills, Cross-Cultural Communication, Quality Management Tools Application, and others. This cluster emphasizes the role of communication in quality control and project management. The integration of factors like Conflict Resolution Effectiveness and Stakeholder Engagement points towards the crucial role communication plays in managing stakeholder relationships and ensuring project quality.
- Cluster 5, "*Resource and Environmental Management*," includes Navigating Organizational Politics, Technology Utilization, Environmental Impact Assessment, and other factors. This cluster illustrates the increasing importance of environmental considerations and resource management in construction projects. Factors like Energy Effectiveness Practices and On-site Waste Management highlight the industry's growing emphasis on sustainable practices.

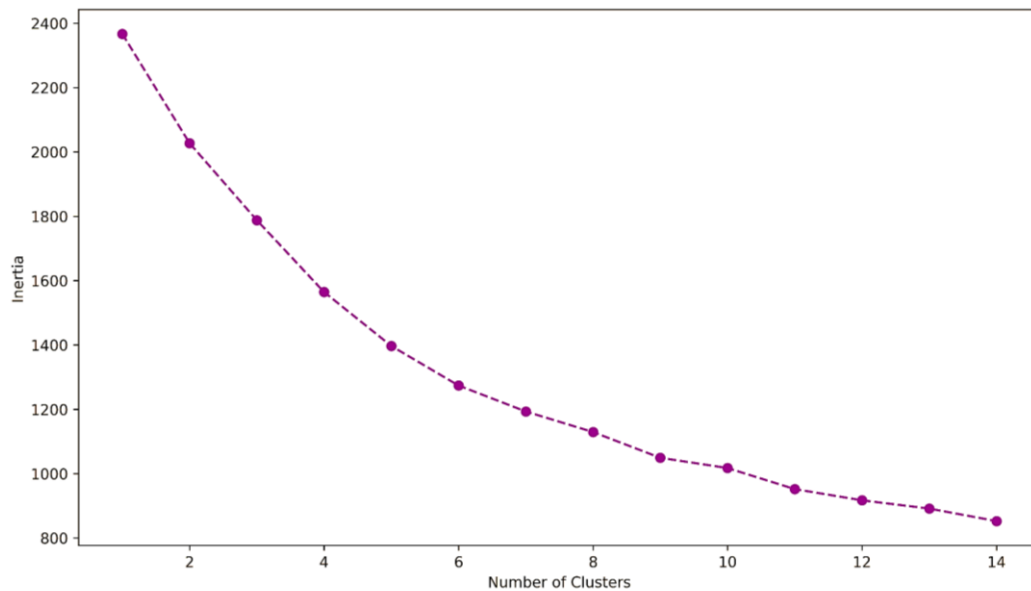


Figure 10. Elbow method for determining the optimal number of clusters

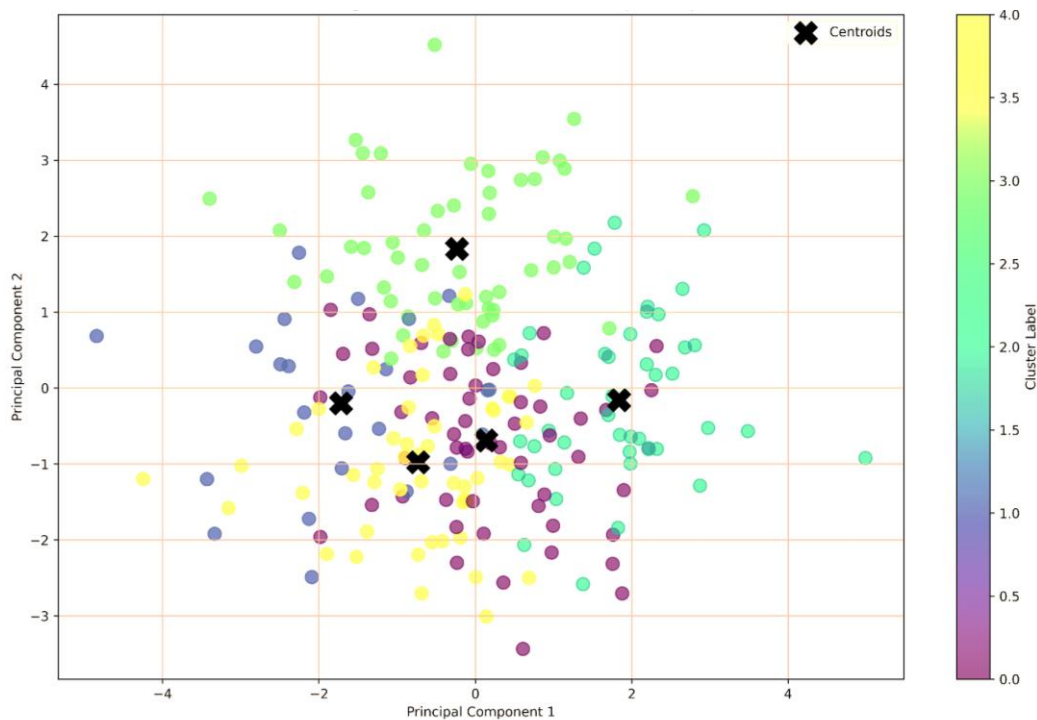


Figure 11. K-Means clustering of examined factors using PCA, with Centroids marked

Indeed, the clustering of these factors into distinct themes provides a structured way to understand the complex interplay of skills and practices in the construction industry. Each cluster represents a different facet of project management, from the concrete aspects of planning and execution (Project Management) to the more abstract elements of leadership and strategy. The grouping also highlights the evolving nature of the construction industry, where traditional skills are being augmented by new priorities such as sustainability and innovation. The factors within each cluster are not isolated; they interact and influence each other. For instance, effective Communication Skills in Communication and Quality Control are essential for Leadership and Strategy, just as Resource and Environmental Management is crucial for effective Project Management. These interdependencies are key to understanding the holistic nature of project management in the construction industry. The identification of these clusters through K-means clustering offers a novel perspective on the multifaceted nature of project management. It provides valuable insights into which areas are seen as crucial by professionals in the industry and how these areas interconnect. This understanding is essential for developing comprehensive strategies to enhance project outcomes, especially in the Pakistani construction industry, where unique cultural, organizational, and environmental factors influence the dynamics of project management.

**Table 2. Grouping of factors based on the K-means clustering results**

Cluster Number	Dominating Theme	Factors Included
1	Project Management	Conflict Resolution, Time Management, Budgeting and Quality Management, Strategic Planning, Documentation and Reporting, Environmental and Sustainability Management, Legal and Regulatory Adaptability, Inter-Departmental Coordination, Task Prioritization, Safety Standards Promotion, Innovation Promotion, External Stakeholder Communication, Customer Needs Integration, Time-Sensitive Management, Inter-Team Communication, Feedback Incorporation, Compliance with Local Regulations, Subcontractor Management, Sustainable Construction Practices, Innovative Construction Techniques, Managing Large-Scale Civil Projects
2	Interpersonal Skills	Adaptability, Negotiation Skills, Team Collaboration, Risk Management, Stakeholder Satisfaction, Risk Identification and Mitigation, Deliverables Management, Understanding of Civil Engineering Technologies
3	Leadership and Strategy	Stakeholder Management, Resource Management, Leadership and Motivation, Quality Management Implementation, Continuous Process Improvement, Crisis Management, Long-Term Strategic Thinking, Scope Management, Team Building, Ethical Standards Maintenance, Continuous Learning, Project Scope-Time-Cost Balance, Ensuring Structural Integrity, Safety Measures in Construction, Handling Logistical Challenges, Zoning and Land-Use Planning, Seismic Design Compliance
4	Communication and Quality Control	Communication Skills, Cross-Cultural Communication, Organizational Alignment, Conflict Resolution Effectiveness, Stakeholder Engagement, Quality Management Tools Application, Cost Management, Project Management Methodologies Utilization, Overall Impact on Project Success, Soil Analysis and Foundation Planning, Managing Projects in Challenging Terrains, Work-site Cleanliness and Organization
5	Resource and Environmental Management	Navigating Organizational Politics, Technology Utilization, Resource Allocation, Expectation Management, Handling Unexpected Events, Enhancing Team Creativity, Environmental Impact Assessment, Water Resource Management, Quality of Construction Materials, Energy Effectiveness Practices, On-site Waste Management, Bridge and Infrastructure Construction

## 6. Findings and Discussions

The high Cronbach's alpha value obtained in this study, indicating strong internal consistency among survey responses, significantly bolsters the credibility of the nuanced findings obtained from the statistical overview and advanced analytical techniques like the Kruskal-Wallis test and correlation analysis. These methods have been instrumental in uncovering a broad acknowledgment of essential managerial skills, particularly emphasizing areas like stakeholder management, conflict resolution, and navigating organizational politics. Such skills are not only indispensable for the success of construction projects but also mirror the unique challenges and cultural nuances specific to the Pakistani construction industry. The survey's results, particularly the mean scores and heatmap analysis, have been pivotal in revealing areas where there is a consensus among professionals and highlighting where there are gaps. For example, the lower mean scores in adaptability and time management suggest these are potential areas for professional development. The varying responses and the significance of different skills across various professional groups, as indicated by the Kruskal-Wallis test, underscore the diversity in professional perspectives and experiences. These insights are crucial for customizing training programs and development initiatives to bolster the competencies of project managers.

On the other hand, the correlation analysis offers valuable insights into how different skills and managerial aspects are interrelated. Positive correlations between factors like conflict resolution and navigating organizational politics, or team collaboration and negotiation skills, highlight the interconnected nature of these competencies in successful project management. Understanding these relationships is critical for devising holistic training programs and strategies that focus on augmenting interrelated skills, thereby enhancing overall managerial efficacy. The PCA and MAD methods have underscored the most significant factors impacting project success. PCA has highlighted the critical role of elements like crisis management and long-term strategic thinking. In contrast, MAD has brought to light the importance of maintaining ethical standards and promoting innovation. These findings suggest a dynamic landscape of project management where traditional skills are complemented by a focus on innovation, ethics, and forward-thinking strategies. Furthermore, the K-means clustering, optimized through the elbow method, has categorized the survey factors into five distinct clusters, each representing unique thematic groupings. These clusters, project management, interpersonal skills, leadership and strategy, communication and quality control, and resource and environmental management, each highlight a different facet of project management.

They underscore the evolving nature of the construction industry, where traditional skills are increasingly augmented by new priorities such as sustainability and technological innovation. The identified clusters and their constituent factors provide a comprehensive roadmap for focusing on key areas that can drive project success. For instance, the project management cluster emphasizes balancing traditional project management skills with innovative practices. The leadership and strategy cluster stresses the importance of strong leadership, ethical conduct, and strategic foresight. Similarly, the communication and quality control cluster signifies the pivotal role of effective communication in managing stakeholder relationships and ensuring project quality. In terms of future directions, developing strategies to address the challenges identified in the Pakistani construction industry is imperative. This strategy should include targeted training programs aimed at enhancing essential skills like adaptability, time management, and conflict resolution. There's also a need to foster a culture of continuous professional development within organizations, emphasizing the importance of interpersonal skills and the ability to navigate complex organizational politics.

Additionally, integrating modern technologies and sustainable practices in construction projects should be prioritized to stay abreast of global trends and standards. Collaborations between industry and academia could be crucial in aligning educational curricula with the evolving needs of the industry. Advocating for policy changes that support innovative and environmentally sustainable construction practices will not only address the current skill gaps but also pave the way for a more efficient, responsible, and forward-thinking construction industry in Pakistan. The findings of this study open numerous avenues for future research and practical applications. There is a clear need for targeted training programs that address the identified skill gaps, particularly in areas such as adaptability and time management. Further research could delve into the specific challenges and opportunities associated with integrating innovative practices and sustainability considerations into the Pakistani construction industry. Additionally, understanding the cultural and organizational dynamics at play can aid in developing more effective strategies for stakeholder engagement and conflict resolution. Research in these areas will be instrumental in enhancing the efficiency, sustainability, and overall success of construction projects in Pakistan and potentially in similar emerging markets.

## 7. Conclusions

The study aims to investigate the critical role of project managers' political skills in enhancing the effectiveness of quality management practices in Pakistan's construction industry. Employing a survey-based methodology that targeted professionals across various construction projects in Pakistan, the research seeks to understand the impact of project managers' political acumen on project outcomes, identify challenges to project success, and propose actionable strategies for skill enhancement. The significant findings of this study are as follows:

- The high Cronbach's alpha value indicated a robust level of internal consistency among the responses, lending credibility to the survey's conclusions.
- The survey highlighted the importance of managerial skills such as communication, stakeholder management, and conflict resolution, with professionals generally agreeing on their significance for project success.
- The study found notable positive correlations between certain skills, such as conflict resolution and navigating organizational politics, and between team collaboration and negotiation skills, underscoring the interconnected nature of these competencies.
- Both PCA and MAD methods identified key factors impacting project success, including crisis management, long-term strategic thinking, stakeholder management, and innovation promotion.
- The clustering of survey factors into five distinct themes provided insights into the multifaceted nature of project management.

Finally, this study makes a significant contribution to the field of construction project management, especially in the context of Pakistan. By highlighting the pivotal role of project managers' political skills and the importance of various managerial and technical competencies, it offers a comprehensive overview of the factors that influence the success of inter-organizational construction projects. The findings not only shed light on the current state of skills and practices in the industry but also provide a foundation for developing targeted strategies to enhance project outcomes. Future research directions could further explore the implementation of these strategies and their impact on the industry, ensuring continuous improvement and success in Pakistan's construction sector.

## 8. Declarations

### 8.1. Author Contributions

Conceptualization, A.H.K. and S.N.; methodology, A.H.K. and S.N.; software, A.H.K.; validation, A.H.K.; writing—original draft preparation, A.H.K.; writing—review and editing, A.H.K. and S.N.; supervision, S.N. All authors have read and agreed to the published version of the manuscript

### 8.2. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

### 8.3. Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

### 8.4. Conflicts of Interest

The authors declare no conflict of interest.



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