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Identifying and Addressing Obstacles to Project Management Office Success in Construction Projects: An AHP Approach

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ABSTRACT

The development of construction projects serves as an indicator of societal progress, reflecting the growth of various project domains in Libya, especially in the Misrata Free Zone. Despite the significance of these projects, they encounter several issues during different stages, including scope changes, delivery delays, and cost overruns. The Project Management Office (PMO) plays a crucial role in ensuring the successful completion of projects, overcoming challenges, and minimizing delays and cost increases through planning, coordination, and monitoring, ensuring that the project stays within its framework and objectives. This paper examines the primary obstacles to establishing a PMO in the Misrata Free Zone using the Analytical Hierarchy Process (AHP). The research findings are expected to lead to key strategies for overcoming these obstacles.

1. Introduction

The construction industry has drawn attention for its lack of project performance and delivery, despite the importance of growth and necessities [1]. The reasons for poor project performance can be numerous and may vary from one project to another. Specialization of resources in new projects, while on time, improves the efficiency and benefit of the construction industry. It enables efficient use of existing human, mechanical, and machining resources. It is pushed by the fact that training of new staff is costly and driven by the need to make the best use of intellectual resources and, in some cases, by the need to retain workers on staff or nearby [2]. The construction industry requires new infrastructure and facilities to satisfy human needs. In the world, sometimes these are buildings to help manufacture goods and services, while other times they are social infrastructure facilities. The use of the term "construction" in this direction refers to infrastructure and has an influence on a nation's standard of living through its direct and indirect impacts.

To accomplish this, human requirements of infrastructure environments must be transformed; that is, the practicality, aesthetics, and safety required by the customers. The processes by which

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humans achieve this transformation are the purpose of the project. Project management is the use of techniques to plan, manage, motivate, and control resources, tools, materials, and tasks to reach defined targets within defined time and cost limits [3]. The work needed to construct each construction project will be specific. The challenge of developing and maintaining a PMO in construction projects is to transform properties into opportunities that lead to the improvement of the project's objectives. Whether or not a company can implement a PMO in construction projects is associated with company policies, culture, business site, and business strategies. A benchmark comparison along these lines shows considerable impacts when implementing PMO.

A Project Management Office (PMO) is established to enhance the efficiency of institutions across various fields. The responsibility of developing projects lies with the PMO, as its primary role is to ensure the success of the project, in addition to ensuring the continuity of prosperity and future development in the institution and society. This includes expanding economic development to meet the requirements of sustainable development amidst existing competitions and leading in planning and successfully managing projects by applying the best global standards, methodologies, and practices [4].

The objectives of the PMO include promoting a culture of project management, training relevant personnel, applying and developing project management methodologies, enhancing individual skills among project managers, improving project quality to achieve their goals with high efficiency, creating a more cohesive and effective project management environment, and providing comprehensive reports to senior leadership on project status, performance indicators, and analyses [5]. The PMO collaborates with other departments without interfering with their powers and contributes to developing the necessary practices and procedures. It also focuses on participation in projects regardless of their size, number, and field, ensuring that standards, procedures, and policies are followed, and providing consultative support.

It is very challenging to convince different specialists within any construction company to follow a common project management process. However, many construction companies still confront a multitude of obstacles. Results show a prevailing lack of top management's commitment, lack of understanding about what the PMO really means - construction PMO not a generic PMO but should be built upon the knowledge of construction industry-related project management under the project-oriented organization - resistance to change, differences between projects' processes, growing scope of work and organizational size and complexity [6,7]. Such obstacles contribute to undermining the role of PM in construction projects and consequently may lead to poor project performance [8].

This paper aims to study the impact of PMO implementation in institutions, identify the main obstacles to establishing a PMO within institutions, and propose some recommendations to assist decision-makers in developing planning and project management methods. The importance of this research stems from the recent developments in recent years under global competition, with the study's local significance increasing due to the current security stability in the country, the resumption of projects, the anticipated future reconstruction projects in the private and public sectors, and the urban development experienced by the institution under study. All these factors highlight the importance of studying the main obstacles facing PMOs within public institutions and the main strategies to overcome these obstacles.

2. Methodology

Multi-Criteria Decision Making (MCDM) is one of the most well-known methods among decision-making techniques [9]. It is a branch of operations research that focuses on solving decision problems involving multiple criteria [10]. These models are often referred to as Multi-Criteria Decision Making or Multi-Criteria Decision Analysis, abbreviated as MCDM [11,12].

Since the inception of the Analytic Hierarchy Process (AHP) by Professor Thomas Saaty in the 1970s, it has become a pivotal method in operations research. Saaty, a pioneer in the field, was also a project manager. His motivation was to create a simple tool to aid ordinary people in making complex decisions. The result was the AHP, a blend of existing concepts that showcases Saaty's genius through its simplicity and power [13].

Numerous studies have applied AHP to address selection problems in the construction industry, investigating issues like supply chain management [14], contractor, site selection [15,16], or sustainability [17].

AHP has various definitions, all with a common essence:

General Definition: AHP is a multi-criteria decision-making method used in virtually all decision-making applications, including selection, evaluation, cost-benefit analysis, risk assessment, resource allocation, planning, development, prioritization, and ranking. It is most frequently used for selection and evaluation.

Technical Definition: AHP is a structured technique for complex decision-making, grounded in mathematics and psychology. It provides a comprehensive rational framework for structuring decision problems, defining goals and criteria, and evaluating alternative solutions. It helps decision-makers understand problems and make the right decisions, organizing decisions into a hierarchical structure comprising goals, main criteria, sub-criteria, and alternatives.

From these definitions, we conclude that AHP is a widely used method for making optimal decisions when multiple criteria are involved. It ensures the resolution of complex problems by analyzing them in a hierarchical structure [18].

To arrive at the best option using AHP, the following steps outlined by Saaty and noted in numerous studies should be followed [19]:

Define the Problem and Goal: Clearly articulate the problem and the objective.

Build the Decision Hierarchy: Construct a hierarchical structure starting from the top with the overall goal, followed by the criteria at intermediate levels, and the alternatives at the bottom.

Construct Pairwise Comparison Matrices: At all levels, create pairwise comparison matrices. The core principle of AHP is using these matrices to obtain relative weights among criteria and alternatives. Each criterion is compared with others based on its contribution to the goal. Each element at a higher level is used to compare elements at the next lower level directly. Preference scores indicating the importance of one element over another are assigned based on Saaty's scale, ranging from 1 to 9, as shown in Table 1.

Table 1
The AHP pairwise comparison scale

Intensity of Importance	Definition
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong importance
9	Extreme importance
2, 4, 6, 8	To present intermediate values between the two adjacent judgments

After performing all pairwise comparisons, it is essential to verify the consistency of each matrix [20]. The consistency of the pair-wise comparison matrix A can be assessed firstly by calculating the consistency index (CI):

$$\mathrm{CI} = (\lambda_{max} - \mathrm{n}) / (\mathrm{n} - 1) \tag{1}$$

where n equals the number of criteria, and λ_{max} equals the principal eigenvalue of matrix A. However, matrix A is consistent if and only if the largest eigenvalue λ_{max} is equal to n [21].

The largest eigenvalue λ_{max} can be calculated as follows:

$$\lambda_{max} = \sum_{j=1}^{n} \frac{(c.v)_j}{n.v_j} \tag{2}$$

where c represents the pairwise comparison matrix, and v represents the matrix eigenvector.

After obtaining the consistency index value (CI), the consistency ratio $(C.R)$ can be computed through dividing consistency index (CI) by the appropriate value of the random index (RI) as shown in Table 2. The appropriate value of random index is selected depending on the number of criteria, for instance, if the number of criteria n (the number of elements being compared) is equal to 4, then the appropriate value of $RI = 0.89$.

$$C.R = CI/RI \tag{3}$$

Table 2
Values of RI

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

The acceptable threshold for the Consistency Ratio is typically 0.1 (or 10%). If the CR is less than or equal to 0.1, the judgments are considered consistent. If the CR exceeds 0.1, it indicates inconsistency in the judgments, and the pairwise comparisons should be reviewed and adjusted accordingly.

The CR is crucial in determining the decision-maker's ability to accurately assess the importance of each element. A thorough review of the judgments is necessary to establish the relative importance of the factors. In the AHP, inconsistency is allowed as long as it does not exceed 0.1, indicating that the evaluation in the matrix is good. Therefore, a certain degree of consistency is essential for calculating the priorities of elements or activities based on a specific criterion to obtain practically acceptable results.

i. The acceptable consistency ratio is more detailed as follows: 5% for a 3×3 comparison matrix, 9% for 4×4 matrices, and 10% for larger matrices.
ii. If the consistency ratio for a pairwise comparison matrix is not achieved, the experts' judgments should be reviewed and revised. Once this is done, the mathematical operations specific to the AHP method should be completed, or specialized software can be used for fast and accurate computations.
iii. Final weights for criteria and alternatives are determined based on the application of the AHP method.

3. Case Study

Figure 1 illustrates the sequential process for doing the research. The process consists of three phases: Data collecting, calculations, and outcomes discussion.

Table 3 displays the main and sub-criteria employed in the research. This list was compiled using data from prior research and expert consultation.

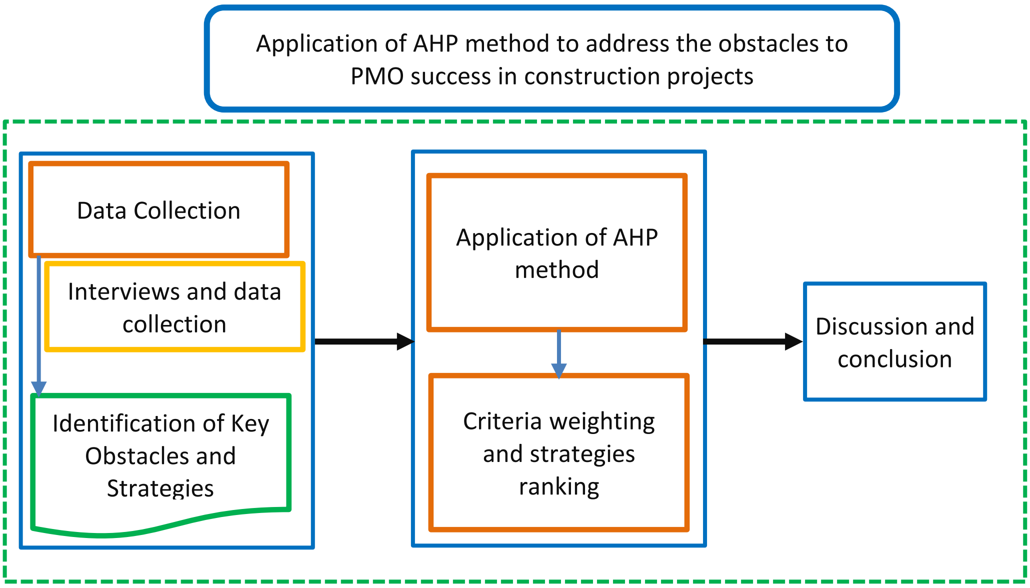

Fig. 1. Sequential process for the research

Table 3
Main and sub-criteria used

Symbol	Main Criteria	Symbol	Sub-criteria
C1	Communication	C11	Weak communication between the PMO office and other departments (higher and executive)
		C12	Neglect by some parties regarding the importance of communication with the PMO office.
		C13	Lack of information technology use in managing communication with the PMO office.
		C14	Difficulty in communicating with some external parties related to the PMO office, such as (Electricity Company, Urban Planning Office, etc.)
C2	Resource Management	C21	Resource constraints affecting the support for and management of the PMO office.
		C22	Lack of experience among supervisory staff (human resource) and absence of a complete job description outlining their duties and specialties.
		C23	Inability to provide some resources for the PMO office.
		C24	Insufficient time allocated for building activities and interactions within the PMO office.
C3	External Environmental Changes	C31	Scarcity of certain materials with specific specifications and high local market prices (e.g., marine environment-resistant steel structures, dock accessories, etc.).
		C32	Overlapping of free zone projects with other entities, such as: (Brega Company, General Electricity Company, General Water and Sanitation Company, etc.).
		C33	Impact of unstable security conditions on local and foreign companies and the presence of legal and political challenges.
		C34	Concerns about economic obstacles, such as fluctuating exchange rates and liquidity issues.
C4	Planning Deficiencies	C41	Inaccurate collection of project requirements.
		C42	Shortcomings and errors in understanding senior management's strategies and requirements.
		C43	Lack of a database for previous projects leading to delays for the PMO office.
		C44	Changes in project objectives by a stakeholder.

From the interviews conducted and the observations recorded, the paper also discusses the key strategies and alternatives that the researcher believes will address the identified constraints. The researcher identified sixteen strategies, detailed in Table 4.

Table 4
Proposed Key Strategies

Symbol	Strategy
S1	Use of collaborative project platforms to create a collaborative approach that simplifies communication with all project participants.
S2	Intensify training sessions and workshops for all stakeholders, emphasizing the importance of communication with the PMO office and keeping everyone updated.
S3	Employ a flexible and smooth modern information technology approach for communication with the PMO office.
S4	Establish joint committees and regular meetings with external parties related to PMO policies and strategies.
S5	Ensure the presence of well-planned financial plans in the relevant departments, as well as the importance of financial guarantees to support the PMO office.
S6	Develop a comprehensive job description outlining the supervisory staff's authorities and tasks, and conduct necessary training to enhance their competence.
S7	Pre-plan and support all resources for the PMO office to enhance its efficiency.
S8	Allocate sufficient time to ensure internal alignment and coordination between the PMO office and other departments.
S9	Procure and store special materials not available in the local market in free zone warehouses.
S10	Form joint committees and hold regular meetings with relevant entities, such as: (Brega Company, General Electricity Company, etc.) to understand their requirements and applicable standards.
S11	Participate in international conferences and exhibitions to demonstrate security stability and introduce investment opportunities.
S12	Engage specialized entities to establish regulations and laws that protect the rights of all parties, and develop planned strategies in collaboration with senior management to address economic obstacles.
S13	Prepare project requirement templates from interested parties and approve them before starting map preparation.
S14	Conduct training sessions to develop the planning team and consult with experienced engineering firms for map preparation.
S15	Communicate with companies that have previously executed projects in the area, gather and archive previous maps both in paper and electronic formats.
S16	Hold meetings with interested parties to clarify project goals in advance.

The researchers prepared and designed a form to rank the main obstacles affecting the PMO. The form outlined how to fill it out and how to convert descriptive expressions into quantitative measures. The form was presented to five experts knowledgeable in project management, both from within and outside the free zone, to evaluate the main obstacles. The results are summarized in Table 4.

The researchers included a table of strategies in the form for evaluation and weighting by the experts, aiming to select the top six strategies for consideration and to complete the AHP hierarchical model. The results consist of six strategies namely S6, S2, S1, S16, S13, and S8.

After identifying the main criteria from the experts, these criteria were used to apply the AHP method. This begins with building the hierarchical structure for the goal, which is to select the most important strategies and alternatives for addressing the challenges faced by the PMO. Figure 2 illustrates the hierarchical structure of the main and sub-criteria along with the key strategies.

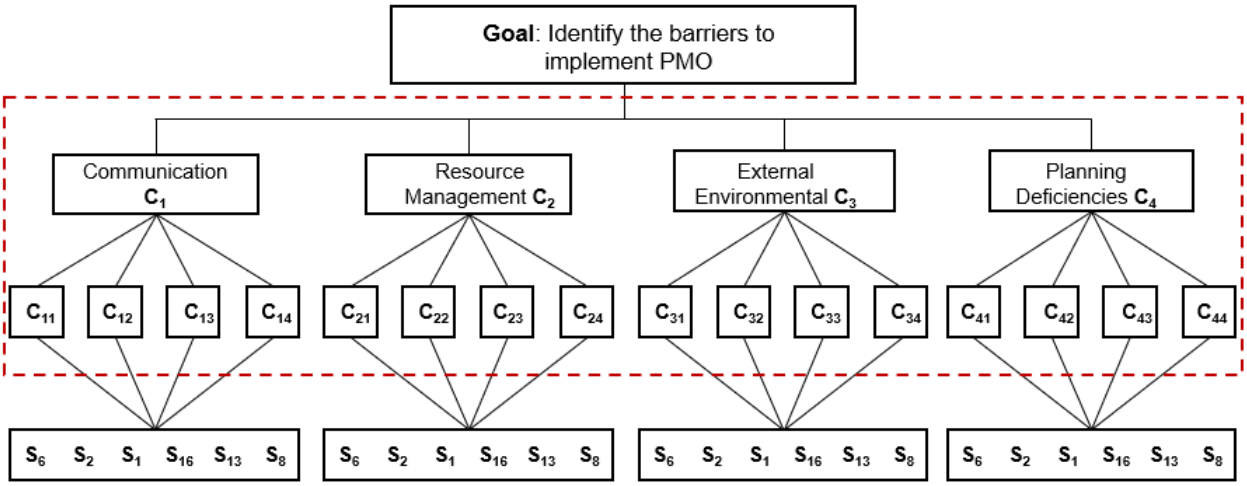

Fig. 2. Problem hierarchy

The researchers prepared a template, which includes tables for comparing the main criteria with the goal, as well as the sub-criteria. This template provides instructions on how to fill it out, including an example for clarification. Five experts with relevant knowledge filled out the template. Tables 5 and 6 summarize the results.

Table 5
Comparison Values Between Main Criteria

Main Criteria	Communication	Resource management	External environmental changes	Planning deficiencies
Communication	1	2	3	3
Resource management	½	1	2	2
External environmental changes	1/3	1/2	1	2
Planning deficiencies	1/3	½	½	1

The consistency ratio (CR) for the pairwise comparison matrix is 0.0027. For the pairwise comparisons to be acceptable and considered consistent, the consistency ratio must be less than or equal to 0.1. In this case, the condition is met, indicating that the level of consistency is acceptable.

Table 6 displays the calculated global priorities for the main criteria. The weights indicate the relative importance of each criterion concerning the goal, based on the pairwise comparisons.

The same method was used to calculate the weights for the sub-criteria. Data collected from the survey was processed to obtain the weights for each sub-criterion, ensuring that their consistency ratio was acceptable.

The analysis reveals that the Communication criterion is the most important among the main criteria, with an importance percentage of 45%, the highest among all criteria. This is followed by the Resource Management criterion, which has an important percentage of 26%. The External Environmental Changes and Planning Deficiencies criteria are ranked third and fourth, with important percentages of 17% and 12%, respectively. Figure 3 displays the local weights for the sub- criteria.

Table 6
Weights of Main and Sub-Criteria

Main Criteria	Weight	CR	Sub-criteria	Global weight
C1	0.45	0.061	Weak communication between the PMO office and other departments (higher and executive)	0.2001
			Neglect by some parties regarding the importance of communication with the PMO office.	0.1189
			Lack of information technology use in managing communication with the PMO office.	0.0831
			Difficulty in communicating with some external parties related to the PMO office, such as (Electricity Company, Urban Planning Office, etc.)	0.0477
C2	0.26	0.099	Resource constraints affecting the support for and management of the PMO office.	0.1366
			Lack of experience among supervisory staff (human resource) and absence of a complete job description outlining their duties and specialties.	0.0722
			Inability to provide some resources for the PMO office.	0.0263
			Insufficient time allocated for building activities and interactions within the PMO office.	0.0248
C3	0.17	0.083	Scarcity of certain materials with specific specifications and high local market prices (e.g., marine environment-resistant steel structures, dock accessories, etc.).	0.0862
			Overlapping of free zone projects with other entities, such as: (Brega Company, General Electricity Company, General Water and Sanitation Company, etc.).	0.0312
			Impact of unstable security conditions on local and foreign companies and the presence of legal and political challenges.	0.0293
			Concerns about economic obstacles, such as fluctuating exchange rates and liquidity issues.	0.0232
C4	0.12	0.019	Inaccurate collection of project requirements.	0.0651
			Shortcomings and errors in understanding senior management's strategies and requirements.	0.0281
			Lack of a database for previous projects leading to delays for the PMO office.	0.0167
			Changes in project objectives by a stakeholder.	0.0102

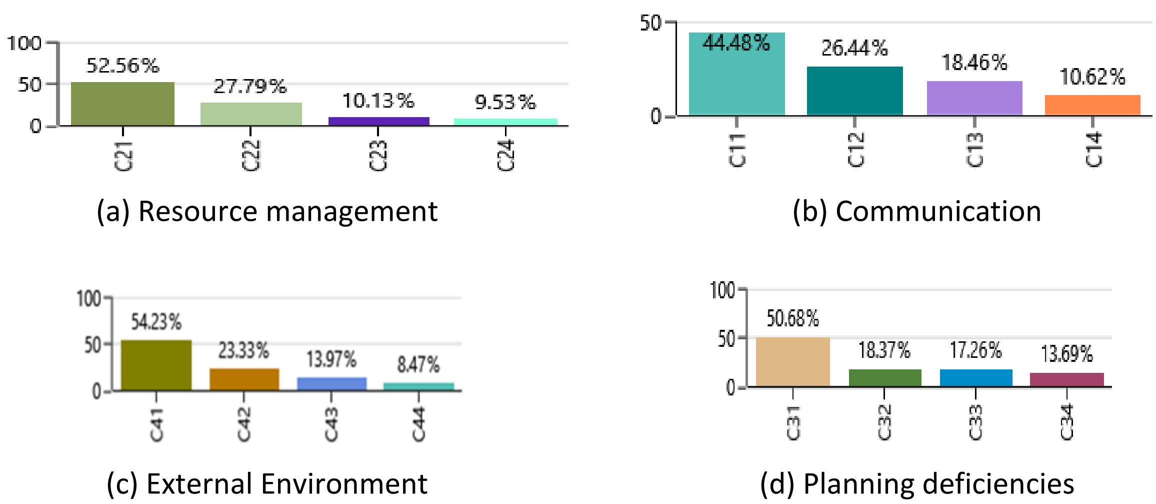

Fig. 3. Local weights of sub-criteria

Figure 4 illustrates the final ranking of strategies that can be implemented within the free zone in Misrata. The priority order of the strategies is as follows:

i. S6: Develop a comprehensive job description outlining the authorities and tasks of supervisory staff, and provide necessary training to enhance their competence.
ii. S2: Intensify training sessions, seminars, and workshops for stakeholders to emphasize the importance of communication with the PMO office and keep everyone updated.
iii. S1: Use collaborative project platforms to establish a cooperative approach to simplify communication among project stakeholders.
iv. S16: Hold meetings with relevant stakeholders to clarify project objectives in advance.
v. S13: Prepare project requirement templates from interested parties and approve them before starting map preparation.
vi. S8: Allocate sufficient time to ensure internal alignment and coordination between the PMO office and other departments.

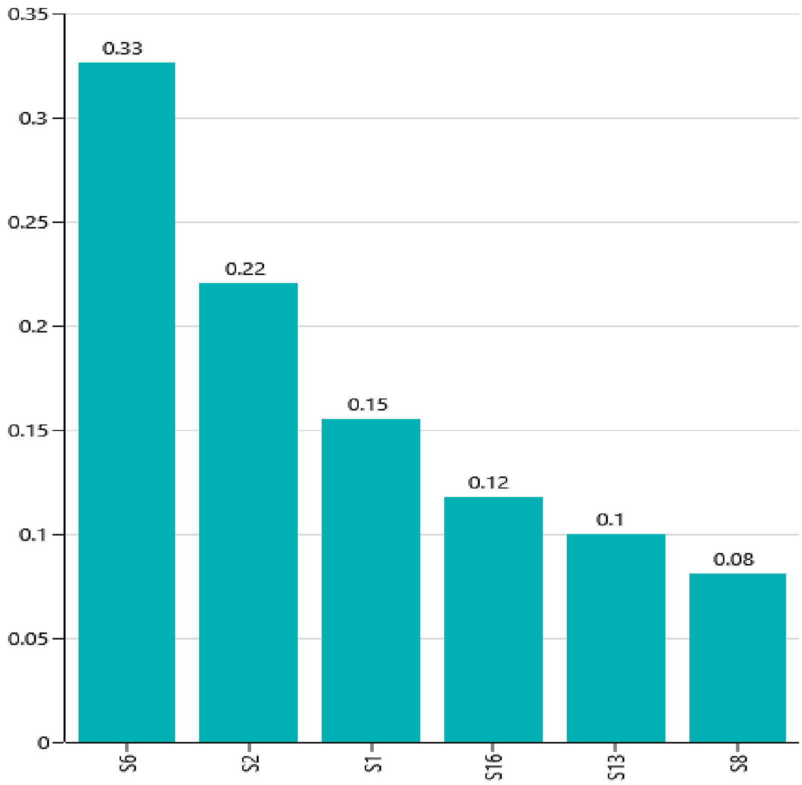

Fig. 4. Strategies ranking

4. Sensitivity Analysis

Sensitivity analysis is an effective tool for testing the robustness of solutions or strategies concerning input parameters or criteria. It helps in understanding how changes in criteria affect the strategies or solutions. When analyzing the sensitivity by removing the Communication criterion, the weights of the remaining criteria are shown below. Figure 5 shows that the strategy S6 is still ranking first.

Criterion	Weight (%)
Resource Management (C2)	49.05
External Environmental Changes (C3)	31.19
Planning Deficiencies (C4)	19.76

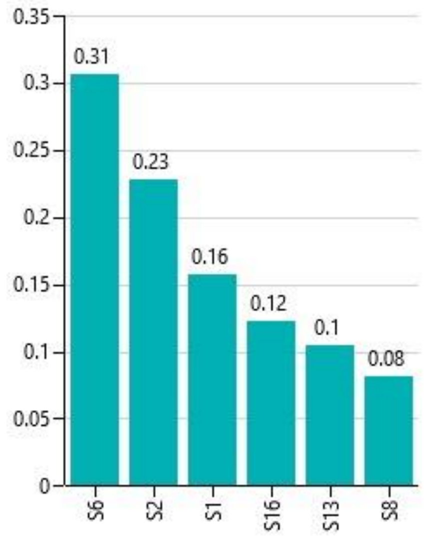

Fig. 5. Strategies ranking

When analyzing the sensitivity by removing the Resource Management criterion, the weights of the remaining criteria are shown below. Figure 6 shows that the strategy S6 is still ranking first.

Criterion	Weight (%)
Communication (C1)	58.89
External Environmental Changes (C3)	25.19
Planning Deficiencies (C4)	15.93

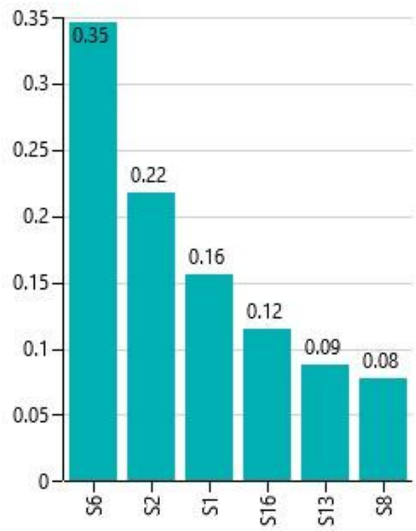

Fig. 6. Strategies ranking

When analyzing the sensitivity by removing the External Environmental Changes criterion, the weights of the remaining criteria are shown below. Figure 7 shows that strategy S6 is still ranking first.

Criterion	Weight (%)
Communication (C1)	53.90
Resource Management (C2)	29.73
Planning Deficiencies (C4)	16.38

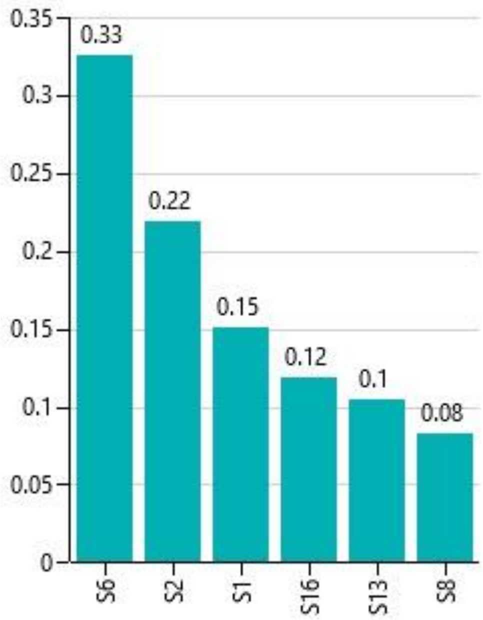

Fig. 7. Strategies ranking

When analyzing the sensitivity by removing the Planning Deficiencies criterion, the weights of the remaining criteria are shown below. Figure 8 shows that the strategy S6 is still ranking first.

Criterion	Weight (%)
Communication (C1)	53.90
Resource Management (C2)	29.73
External Environmental Changes (C3)	16.38

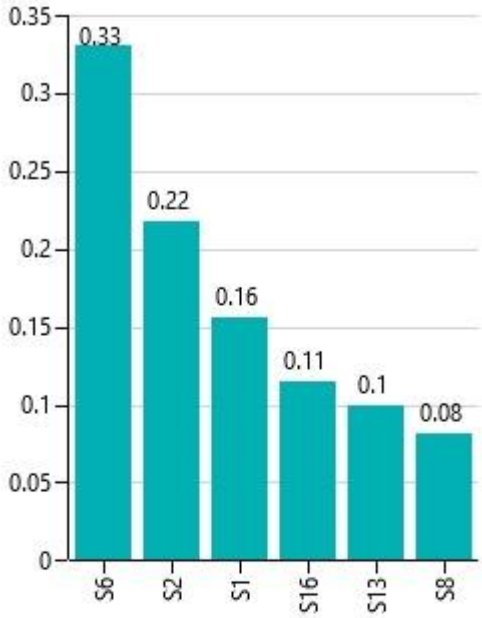

Fig. 8. Strategies ranking

The stability in the ranking of strategies when altering the main criteria indicates that the strategies are robust and consistent in their ordering. This stability suggests that the strategies have a uniform impact on the criteria, demonstrating their effectiveness and reliability, as shown in Figure 9.

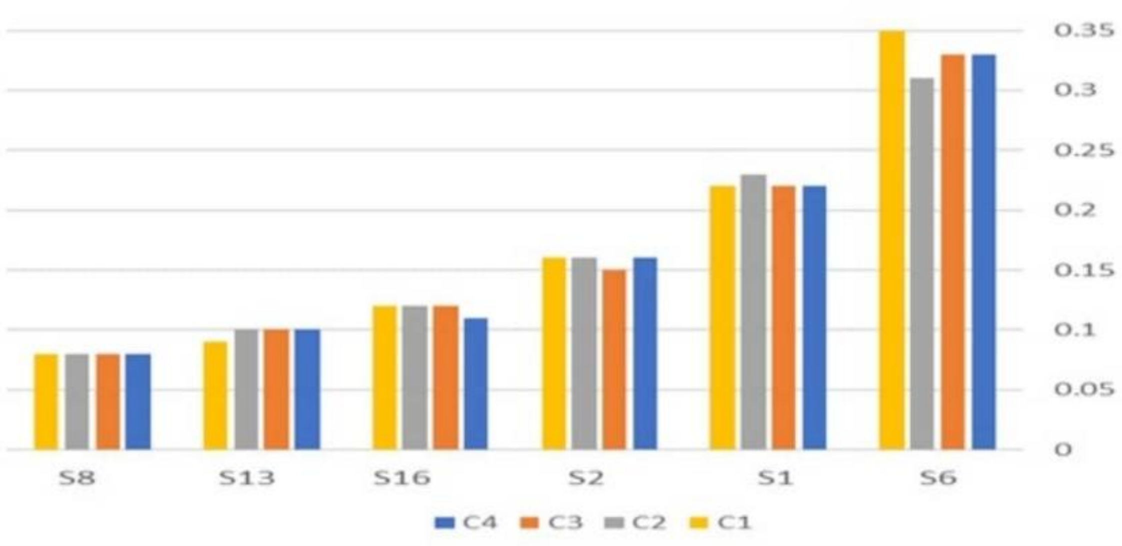

Fig. 9. Sensitivity Analysis Diagram for Strategies

5. Conclusion

In conclusion, the establishment of a PMO is essential for enhancing the efficiency and effectiveness of construction projects in the Misrata Free Zone. This study has identified several critical obstacles that hinder the successful implementation of a PMO, including lack of top management commitment, resistance to change, and the complexity of integrating standardized project management processes within construction companies. By using the Analytical Hierarchy Process (AHP), this research has provided a structured approach to prioritize these obstacles and develop strategies to address them.

The findings emphasize the importance of fostering a culture of project management, enhancing the skills of project managers, and ensuring continuous communication and collaboration across departments. Implementing these strategies can lead to improved project performance, reduced delays and cost overruns, and ultimately contribute to the socio-economic development of the Misrata Free Zone. Decision-makers are encouraged to consider these recommendations to overcome the identified challenges and ensure the successful establishment and operation of PMOs in the construction sector.

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Conflicts of Interest

The authors declare no conflicts of interest.

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