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Success Factor Prioritisation for Industrial Construction Projects in Iran: A Fuzzy DEMATEL-ANP Analysis of MAPNA Company

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Abstract

Success in industrial construction project plays an important role in gaining the competitive advantage of the large-scale infrastructure enterprises. The present research proposes a hybrid fuzzy Multi-Criteria Decision-Making (MCDM) methodology to enhance the success in MAPNA Company, which is one of the largest contractors in the Middle Eastern oil industry. The new hybrid fuzzy MCDM framework is presented through the combination of fuzzy DEMATEL and fuzzy ANP methods and also extended to take into consideration the composite materials like Fiber-Reinforced Polymer (FRP), carbon fiber, and glass fiber. In accordance with the literature review, expert opinion, and Delphi technique from 10 experts, seven main criteria and 45 sub-criteria have been determined. Through the fuzzy DEMATEL method, the analysis of cause-effect relationship between the criteria has been conducted, and the results show that project management has the highest level of impact (D = 5.591), while project-related parameters are the most sensitive (R = 5.652). The threshold value of 0.737 has been considered to form Network Relation Map (NRM). Then, the fuzzy ANP method has been performed to prioritize the criteria. It was found that contractor related factors (normalized weight = 0.177) are the most important amongst main criteria, then project manager related factors (0.175), and finally project management (0.151). As far as the sub-criteria level is concerned, "construction regulations" (S8) has been awarded highest priority (weight = 0.0493) overall, while "customer influence" (S41 = 0.0378) and "certification of products and services" (S9 = 0.0368) were other highly prioritized criteria at this stage. In addition, composite-specific sub-criteria including material certification, specialized fabrication technology, supply chain assurance, and sustainability have also been incorporated in the extended model. FDANP framework offered as an innovative approach is quite reliable as a decision support system in dealing with complexities associated with uncertainties and interrelations in the context of industrial construction projects, especially those using composite materials.

Keywords: Industrial construction projects, Composite materials, Project success, Fuzzy ANP, Fuzzy DEMATEL, FDANP, MAPNA Company.

1 | Introduction

Construction is one of the most important industries that helps in the economic development of many countries, especially in developing nations. In Iran, industrial construction projects like power plant

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construction, oil and gas plants, transportation systems, and heavy industries have an important role in realizing the development plans of the country. Nevertheless, there are a number of difficulties that arise during the course of implementation, which include budget over-runs, schedule over-runs, quality problems, and disputes between stakeholders [1], [2]. Such problems do not only result in losses but can even jeopardize the success of the projects themselves.

As a leading Engineering, Procurement, and Construction (EPC) contractor within Iran and the wider Middle Eastern region, MAPNA Company has undertaken a variety of successful industrial construction projects. Nevertheless, the company acknowledges the need to adopt a more structured approach towards identifying and ranking the Critical Success Factors (CSFs) of its industrial construction projects. The traditional approach adopted in project management through the classical iron triangle, which consists of time, cost, and quality, is no longer effective enough for handling the issues and uncertainties faced in industrial construction projects.

The use of high-performance composite materials like Fiber Reinforced Polymer (FRP), carbon-fibre composites, and glass-fibre reinforced composites has been widely adopted in industry construction in recent times. There is an array of benefits associated with their use, among which is their excellent strength-to-weight ratio, outstanding resistance to corrosion, flexibility in design, lower maintenance costs, and increased energy efficiency [3], [4]. On the other hand, there have emerged several complexities in the process of using these materials due to several issues like certification and qualification, fabricating processes, logistics, durability, and adherence to international regulations [5-7].

The existing body of research on factors affecting the success of projects has mainly concentrated on the use of traditional materials such as steel and concrete, along with traditional construction methods. While many researchers have found out the most important factors that ensure successful construction projects [4], [8–10], as far as the authors know, none of them have considered both 1) the interconnections as well as causation among the factors, and 2) the inclusion of composite material-related aspects. In addition, the uncertain nature of expert assessments requires the use of the fuzzy approach together with Multi-Criteria Decision-Making (MCDM) tools.

This paper attempts to address this issue by developing a framework for MCDM using fuzzy methodology for enhancing the success of industrial construction projects at MAPNA Company. The proposed approach consists of applying the Delphi technique for identifying and selecting the criteria; the fuzzy DEMATEL method for investigating causal relations between the criteria; and the fuzzy ANP model for criteria prioritization, along with the inclusion of composite material-related considerations.

The main objectives of this research are as follows:

I. To identify the key success criteria for industrial construction projects, with particular emphasis on projects involving advanced composite materials.
II. To investigate the internal relationships and interdependencies among these criteria using fuzzy DEMATEL, distinguishing cause factors from effect factors.
III. To prioritise the identified criteria and sub-criteria using fuzzy ANP, accounting for both expert judgment under uncertainty and the specific characteristics of composite materials.
IV. To provide practical, actionable recommendations for MAPNA Company and similar EPC contractors to improve project success rates in composite-intensive industrial projects.

The rest of the paper is organized as follows: Section 2 provides an extensive literature review on CSFs, fuzzy MCDM techniques, and uses of composite materials in construction. Section 3 describes the research method that consists of Delphi process, fuzzy DEMATEL, and fuzzy ANP techniques. Section 4 contains the results of this research work along with discussion based on the developed causal diagrams, prioritization, and limit supermatrix. The conclusion is provided in Section 5.

2 | Literature Review: Critical Success Factors in Industrial Construction Projects

Project success in industrial construction is a multi-dimensional phenomenon that goes beyond the conventional concept of the iron triangle of time, cost, and quality. During the last thirty years, there has been an ongoing effort from the research community to pinpoint and develop a framework for the CSFs that result in successful projects. This section provides a summary of the developments of CSFs, MCDM techniques, and industrial construction.

2.1 | Evolution of Critical Success Factors in Construction

The early fundamental studies provided the basis for understanding CSFs. The early comprehensive framework established certain factors such as commitment of project team, competencies of the owner, and accurate cost estimation as key success elements [11]. Other pioneering frameworks reinforced the concept of success factors by emphasizing aspects such as customer satisfaction, strategic alignment, and risk management besides the conventional criteria [1], [12].

Recently, there have been several studies to categorize success factors and study how they are interrelated. An example is where certain factors such as economic stability and dependability of contractors were studied within a certain market environment in Europe [1]. In addition, a project success assessment framework proposed that success factors are dynamic and change throughout the life cycle of a project while project management competencies and customer consultations remain key success elements [9].

2.2 | Multi-Criteria Decision-Making Approaches (Fuzzy DEMATEL and ANP)

However, traditional statistical models are usually unable to incorporate causal relations and uncertainties in the judgements of experts. That is why there has been a tendency towards using fuzzy MCDM approaches in recent years. The use of fuzzy DEMATEL with ANP has proven the fact that the environmental variables are net-causes while the project implementation variables are net-effects [13]. Building on this idea, another researcher has developed an integrated fuzzy DEMATEL-fuzzy ANP approach for evaluation of construction projects, proving the importance of interdependencies among decision-making criteria in obtaining proper ranking of the alternatives [14]. The justification for using the concept of feedback and interdependence among the decision making elements that plays a very important role in construction ecosystem analysis has already been given previously [10].

2.3 | Contractor, Manager, and Customer-Centric Factors

The roles of stakeholders have been addressed in recent literature. The effect of integration management on construction effectiveness has been studied, demonstrating that the coordination ability of contractors and capability of the project manager are critical [2]. Research carried out to understand success factors of projects in a particular national setting (Iran) has further proven that institutional factors, especially construction regulations, are the main determinants [15]. This is consistent with studies done in relation to the study of cost factors affecting project outcomes [16].

Moreover, research related to critical factors in contractors has been done extensively. The results of research show that the success of implementation of a safety program depends on the commitment of contractors and use of technology [6]. CSFs analysis in projects using contemporary approaches of MCDM shows that "technical capability of the contractor" and "financial stability" are some of the most important success factors [7]. Concerning project managers, in a hybrid MCDM approach, researchers showed that "delegation", "trust", and "technical expertise" are the most important CSFs for project managers [17].

2.4 | Sustainable, Technological, and Emerging Factors

Sustainability and reverse logistics have emerged as two additional dimensions of success in the modern construction environment. The use of a fuzzy decision support system for choosing sustainable construction projects demonstrated that compliance with environmental regulations and product certification (ISO standards) are now vital rather than desirable [18]. Debates regarding future trends in energy-efficient buildings revealed that composite materials and technology offer significant competitive advantages. Key success factors to facilitate modular off-site construction have been systematically outlined [19].

More recently, research relating sustainable material performance with project success revealed that the customers' influence and technical expertise were important determinants of sustainable practices [3]. An indirect policy strategy related to reverse logistics in construction revealed that institutional factors like regulation and certifications were important indicators for long-term viability of a project [20]. External and institutional factors have also been discussed in the context of sustainable construction [4]. In addition, the study regarding influencing factors for program management performance revealed that contractor and customer factors were highly significant [21]. A sequential hybrid methodology using MCDM is a recent methodology developed to handle project success analysis issues [17]. A new hybrid MCDM method with grey numbers has also been suggested for such projects [22].

2.5 | Synthesis and Research Gap

However, only a few studies have considered the simultaneous application of fuzzy DEMATEL and fuzzy ANP for determining internal cause-and-effect relationships and for weighting the sub-criteria, respectively, especially in relation to large scale industrial contractors like MAPNA company [15]. Also, the appearance of technology and customers' power as first rank success criteria demands an empirical verification through hybrid MCDM models [19], [22]. In response to this need, the current research proposes a FDANP model for industrial construction success.

3 | Research Methodology

In this paper, we try to develop a model that helps us to increase the effectiveness of the industrial construction projects with the application of a fuzzy MCDM approach. In fact, this research can be considered as an applied one and at the same time is descriptive-survey in its nature and method. Statistical populations consist of 10 people who have the title of expert and are from MAPNA Company.

Research methods include several stages such as identification of the success criteria for industrial construction projects. Secondly, relationships between those important criteria will be identified using fuzzy DEMATEL approach. Thirdly, fuzzy ANP approach should be used to rank criteria and sub-criteria. Finally, the calculation of a limit super matrix should be done.

3.1 | Fuzzy DEMATEL Technique

To incorporate the relationship between the key criteria, the fuzzy DEMATEL approach is used. In this approach, the experts can provide their viewpoints on the influence of factors from one to another in terms of direction and strength. The generated matrix (matrix of internal relation) consists of not only the cause-and-effect relation between the variables but also the influence and susceptibility between the variables. The fuzzy linguistic scale is shown in *Table 1*.

Table 1. Fuzzy linguistic scale for DEMATEL.

Linguistic Variable	Crisp Value	Fuzzy Equivalent		
		l	m	u
No influence	0	0.0	0.1	0.3
Low influence	1	0.1	0.3	0.5
Medium influence	2	0.3	0.5	0.7
High influence	3	0.5	0.7	0.9
Very high influence	4	0.7	0.9	1.0

3.2 | Fuzzy ANP Method

For the second phase, criteria are paired off against one another with regard to the overall objective. Pairwise comparisons are done using the Saaty scale, which is a nine-point scale. The fuzzy representation of the Saaty scale is given in *Table 2* below.

Table 2. Fuzzy equivalent of the nine-point Saaty scale for fuzzy AHP/ANP.

Verbal Judgment	Fuzzy Equivalent	Inverse Fuzzy Equivalent
Equally preferred	(1, 1, 1)	(1, 1, 1)
Intermediate	(1, 2, 3)	(1.3, 1.2, 1)
Moderately preferred	(2, 3, 4)	(1.4, 1.3, 1.2)
Intermediate	(3, 4, 5)	(1.5, 1.4, 1.3)
Strongly preferred	(4, 5, 6)	(1.6, 1.5, 1.4)
Intermediate	(5, 6, 7)	(1.7, 1.6, 1.5)
Very strongly preferred	(6, 7, 8)	(1.8, 1.7, 1.6)
Intermediate	(7, 8, 9)	(1.9, 1.8, 1.7)
Extremely preferred	(9, 9, 9)	(1.9, 1.9, 1.9)

4 | Results and Analysis

4.1 | Identification of Success Factors

Based on the literature review and expert opinions, the most important success factors for industrial construction projects in MAPNA Company are identified as follows:

I. External factors (C1)

II. Institutional factors (C2)

III. Project-related factors (C3)

IV. Project management (C4)

V. Project manager-related factors (C5)

VI. Contractor-related factors (C6)

VII. Customer-related factors (C7)

4.2 | Fuzzy DEMATEL Results

Relation matrix (M) was generated based on the average opinion of the experts, which had undergone fuzzification process. The threshold value, after normalization and generation of total relation matrix (T), was fixed to be 0.737. Subsequently, the defuzzification process of the total relation matrix was conducted via the CFCS algorithm.

Table 3. Defuzzified total relation matrix (T) for main criteria.

	C1	C2	C3	C4	C5	C6	C7
C1	0.729	0.829	0.878	0.770	0.717	0.775	0.817
C2	0.789	0.689	0.827	0.724	0.664	0.727	0.762
C3	0.749	0.749	0.708	0.702	0.649	0.733	0.700
C4	0.839	0.837	0.883	0.687	0.706	0.798	0.842
C5	0.715	0.728	0.801	0.693	0.573	0.703	0.736
C6	0.735	0.729	0.801	0.657	0.645	0.701	0.747
C7	0.720	0.726	0.753	0.658	0.586	0.697	0.714

The sum of rows (D) and columns (R), as well as (D+R) and (D–R), were calculated to determine the cause-and-effect relationships. Table 4 summarises these values.

Table 4. The (D), (R), (D+R), and (D–R) values for main criteria.

Criterion	D	R	D+R	D–R
External factors (C1)	5.515	5.275	10.790	0.240
Institutional factors (C2)	5.181	5.288	10.469	–0.106
Project-related factors (C3)	4.991	5.652	10.643	–0.660
Project management (C4)	5.591	4.891	10.482	0.700
Project manager factors (C5)	4.949	4.540	9.488	0.409
Contractor-related factors (C6)	5.015	5.134	10.149	–0.118
Customer-related factors (C7)	4.854	5.318	10.172	–0.464

From *Table 4*, it is evident that project management (C4) is the criterion with the highest level of influence (D = 5.591), whereas project-related factors (C3) are the criteria with the greatest degree of susceptibility to influence (R = 5.652). In addition, external factors (C1) interact most with other criteria (D+R = 10.790). If the value of D–R is positive, then the criteria are net causes (C1, C4, C5).

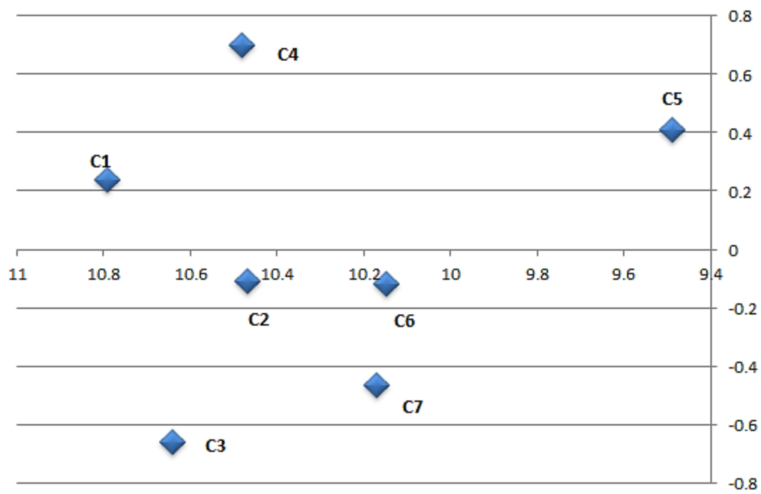

Fig. 1. Cartesian coordinate plot of DEMATEL output for the main criteria.

4.3 | Fuzzy ANP Results

4.3.1 | Pairwise comparisons of main criteria

Overall, the number of pairwise comparisons performed by the expert panel was 21. For each set of pairwise comparisons, the geometric mean method was applied for aggregation. The fuzzy pairwise comparison matrix of criteria is provided in *Table 5*.

Table 5. Aggregated fuzzy pairwise comparison matrix for main criteria.

	C1	C2	...	C7
C1	(1, 1, 1)	(0.69, 0.61, 0.52)	...	(1.23, 1.08, 0.93)
C2	(1.91, 1.64, 1.44)	(1, 1, 1)	...	(0.91, 0.73, 0.59)
...	...	...	...	...
C7	(1.07, 0.93, 0.81)	(1.69, 1.37, 1.10)	...	(1, 1, 1)

After defuzzification using the centre-of-gravity method, the normalised weights of the main criteria were obtained. *Table 6* presents the final defuzzified weights.

Table 6. Defuzzified and normalised weights of main criteria.

Criterion	Defuzzified Weight	Normalised Weight	Rank
Contractor-related factors (C6)	0.182	0.177	1
Project manager factors (C5)	0.180	0.175	2
Project management (C4)	0.156	0.151	3
Customer-related factors (C7)	0.155	0.150	4
Institutional factors (C2)	0.151	0.146	5
External factors (C1)	0.104	0.101	6
Project-related factors (C3)	0.103	0.100	7

The inconsistency rate for the pairwise comparisons was 0.026, which is less than 0.1, indicating acceptable consistency.

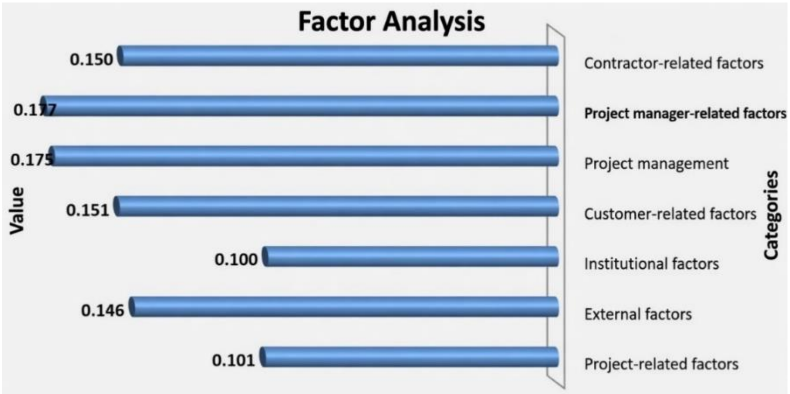

Fig. 2. Graphical representation of the priorities of the main criteria.

4.3.2 | Sub-criteria priorities

The same pairwise comparison was carried out for sub criteria under each criterion. Normalized weights for all the sub criteria were calculated in a similar way. Local weights for sub criteria under each criterion are given in *Tables 7-13*.

Table 7. Weights of sub-criteria for external factors (C1).

Sub-Criterion	Weight	Rank
Social environment (S2)	0.234	1
Legal environment (S5)	0.169	2
Economic environment (S1)	0.166	3
Political environment (S3)	0.155	4
Nature and environment (S6)	0.150	5
Physical environment (S4)	0.126	6

Table 8. Weights of sub-criteria for institutional factors (C2).

Sub-Criterion	Weight	Rank
Construction regulations (S8)	0.337	1
Certification of products/services (S9)	0.252	2
Construction permits (S7)	0.242	3
Construction standards (S10)	0.169	4

Table 9. Weights of sub-criteria for project-related factors (C3).

Sub-Criterion	Weight	Rank
Equipment and materials (S14)	0.157	1
Monitoring (S15)	0.144	2
Profitability (S17)	0.130	3
Sufficient resources and finance (S18)	0.122	4
Construction method (S16)	0.119	5
Procurement (S12)	0.114	6
Clear and realistic goals (S11)	0.112	7
Planning (S13)	0.101	8

Table 10. Weights of sub-criteria for project management (C4).

Sub-Criterion	Weight	Rank
Technical capabilities (S25)	0.199	1
Qualification of project management staff (S20)	0.170	2
Risk identification and allocation (S24)	0.161	3
Relevant past experience (S19)	0.135	4
Organisational structure (S23)	0.134	5
Decision-making effectiveness (S21)	0.102	6
Control system (S22)	0.099	7

Table 11. Weights of sub-criteria for project manager factors (C5).

Sub-criterion	Weight	Rank
Technical capabilities (S27)	0.199	1
Trust (S32)	0.188	2
Delegation and responsibility (S31)	0.145	3
Relevant past experience (S26)	0.136	4
Coordination skills (S30)	0.117	5
Organising skills (S29)	0.115	6
Leadership skills (S28)	0.100	7

Table 12. Weights of sub-criteria for contractor factors (C6).

Sub-criterion	Weight	Rank
Advanced technologies (S39)	0.199	1
Company experience (S34)	0.170	2
Working conditions (S38)	0.161	3
Technical and professional capabilities (S33)	0.135	4
Quality issues (S37)	0.134	5
Financial and economic status (S35)	0.102	6
Top management support (S36)	0.099	7

Table 13. Weights of sub-criteria for customer factors (C7).

Sub-Criterion	Weight	Rank
Customer influence (S41)	0.252	1
Timely decision-making ability (S42)	0.173	2
Risk attitude (S44)	0.158	3
Ability to participate in project phases (S45)	0.155	4
Customer profitability (S40)	0.148	5
Clear and precise goals (S43)	0.115	6

4.4 | Final Ranking Using FDANP (Limit Supermatrix)

The un-weighted supermatrix has been calculated using the summation of criterion weights and the relationship matrix of DEMATEL. Then, the weighted supermatrix, normalized with respect to column sums, was raised to sufficiently high powers until it reached convergence to form the limit supermatrix. The normalised weight of all sub-criteria is shown in *Table 14*.

Table 14. Final weights and overall ranking of sub-criteria.

Main Criterion	Sub-Criterion	Code	Final Weight	Overall Rank
Institutional (C2)	Construction regulations	S8	0.0493	1
Customer (C7)	Customer influence	S41	0.0378	2
Institutional (C2)	Certification of products/services	S9	0.0368	3
Institutional (C2)	Construction permits	S7	0.0353	4
Contractor (C6)	Advanced technologies	S39	0.0350	5
Project manager (C5)	Technical capabilities	S27	0.0348	6
Project manager (C5)	Trust	S32	0.0327	7
Project management (C4)	Technical capabilities	S25	0.0304	8
Contractor (C6)	Company experience	S34	0.0300	9
Contractor (C6)	Working conditions	S38	0.0284	10
… (other sub-criteria)	…	…	…	…

Table 14 demonstrates that Construction regulations (S8), with a weight of 0.0493, is the top ranked sub criterion, followed by Customer influence (S41) and Certification of products and services (S9) with weights of 0.0378 and 0.0368.

5 | Discussion and Conclusion

5.1 | Results Review

An integrated fuzzy MCDM framework was designed by employing both fuzzy DEMATEL and fuzzy ANP techniques to increase the success of industrial construction projects within MAPNA company. Seven major success criteria and 45 sub-criteria were determined with the help of a Delphi study among ten experts. The results of the fuzzy DEMATEL technique indicated that the project management (C4) criterion plays a key role (D= 5.591), and that the project related criteria (C3) are highly affected by the other factors (R = 5.652). The external factors (C1) showed the highest interaction between each other (D + R = 10.790). The D – R scores led to finding out that the project management (0.700), external factors (0.240), and the project manager-related factors (0.409) are cause variables, and institutional factors (-0.106), project related factors (-0.660), contractor related factors (-0.118), and customer related factors (-0.464) are effect variables.

The fuzzy ANP weights put into consideration the contractor related factors (C6) to be the most critical criteria (normalised weight = 0.177), followed by factors associated with project managers (0.175) and the project management itself (0.151). Nevertheless, after taking into account the internal relationships using FDANP limit supermatrix, the rankings in the final order have been significantly revised. With regard to the sub-criteria, construction regulations (S8) are now considered the most crucial factor (final weight = 0.0493), followed by customer influence (S41 = 0.0378) and product/service certification (S9 = 0.0368).

5.2 | Interpretation of Findings

That project management is the most significant (cause) determinant is obviously logical. The roles played by project management, such as planning, control, risk assignment, and coordination, are the very determinants that create the environment for other determinants to operate in. Good project management can offset any uncertainty arising from the external environment, balance the capacity of the contractors, and meet the expectations of the clients. On the other hand, bad project management increases risk and enhances the negative effects of other determinants.

The focus of the construction regulations (S8) as the only sub-criterion rated most highly is due to the fact that construction in Iran is characterized by very stringent and often inconsistent building codes, environmental laws, and standards for health and safety. Knowledge of such regulations and ability to meet all of them gives a competitive edge to the company whereas inability leads to delays and penalties. The importance of meeting construction regulations becomes especially obvious in the case of industrial constructions utilizing composite materials and requiring international certification (ISO, ASTM etc.).

The importance attributed to the criteria of customers' influence (S41) and the certification of products and services (S9) indicates the changing power dynamics in modern construction industry. No longer do customers have to be content with receiving finished construction works – nowadays they participate actively in decision-making process regarding such things as choice of material and design of the project. The certification itself, however, is the external control which mitigates information asymmetry between contractors and clients.

5.3 | Comparison with Previous Literature

The results obtained in this paper are largely in line with other studies, while providing additional contributions to knowledge. The importance attached to the issues related to contractors is also supported by the results of the study conducted by Demirkesen and Ozorhon [2], which proved that successful project management can be achieved through efficient contractor coordination in terms of integration management. Moreover, the findings regarding the significance of client influence correspond to the results of Todorović et al. [9], who pointed out that client consultation and contractor competency are the most important factors regardless of the life cycle phase of the project.

Finally, the importance of construction regulations as the first priority sub criterion supports the results of Gudienė et al. [8] concerning the importance of such context-specific factors in the Lithuanian construction sector. In addition, in case of developing countries like Iran, regulatory factors become particularly important, which supports the findings made by Chamani et al. [23].

But the current study differs from some previous studies in this respect. Kiani Mavi and Standing [13] believed that external environment was the key factor; but our findings indicate that contractor-specific factors and customers outweighed external factors. The explanation to this lies in the unique characteristics of the MAPNA Company as an experienced and powerful EPC Contractor in the market. In case of such organisations, uncertainties of external environment are internalised to a certain extent by means of their risk management systems, while contractor competency and customers distinguish them from other companies.

5.4 | Theoretical Implications

First, the current research contributes theoretically to project management and construction engineering by further extending the use of hybrid fuzzy MCDM models (i.e., fuzzy DEMATEL and fuzzy ANP) into the context of industrial construction projects that utilise advanced composite materials. Although hybrid fuzzy MCDM techniques have been used individually in some earlier studies [10,] [13], [14], their combination in a unified framework with composite material-based criteria represents an innovative attempt.

Second, the research confirms theoretically the differentiation between cause and effect aspects associated with successful industrial construction projects. More specifically, the findings obtained show that factors such as project management, external factors, and project manager-related factors qualify as net causes, providing a rationale for resource allocation based on cause-effect relationship. The resources must be allocated to the enhancement of causes because better conditions would result in positive impacts in effect factors.

Third, the study proposes a number of composite material-related criteria (material certification, technology fabrication, supply chain reliability, etc.) that contribute to the current body of literature on CSFs. This contribution is a response to the recent calls for a material science perspective in project management literature [3], [4], [24].

5.5 | Practical Implications (Managerial Implications)

Recommendations that can be drawn from the outcomes of this research can be stated for project managers, top executives, and policymakers in terms of project management organisations such as MAPNA Company.

Project managers: As project management constitutes the most critical criterion, an effort to develop capabilities in the area of project management needs to be considered. In particular, training in risk management, control system and decision making efficiency would help. Focus should be given on the highly ranked sub-criteria under project management category including technical capability (S25), qualifications of project management team (S20), and risk identification and allocation (S24).

Top executives and procurement department: Contractor should prefer contractors who possess experience and stable finance in addition to technological capability of the firm. According to the outcomes of the survey, contractors are considered more important than any other criteria. Sub-criteria including advanced technology (S39), company experience (S34), and working condition (S38) need to be stated.

For regulatory compliance officers: The importance of construction regulations (S8) cannot be overstated. Organizations are advised to create monitoring teams whose task would be to monitor any changes in the construction code, environmental standards, and safety regulations. It will not only save time on the project but also help organizations avoid penalties.

For customer relationship managers: Client influence (S41) stands second from the highest score; therefore, organizations have no choice but to involve their clients in decision-making processes and ensure good client relations. Organizations should put extra effort into creating an efficient mechanism of communication with their clients, and making timely decisions (S42) will be crucial. It will also help organizations to learn about their clients' risk aversion (S44).

For composite material specialists: The new framework proves once again the importance of the certification of composite materials, specialized composite material fabrication technologies, and reliable supplier relationships when working with FRP, carbon fibre, and glass fiber composites.

5.6 | Limitations of the Study

However, there are several limitations that need to be mentioned in relation to the contribution made by this study.

I. The sample used in the survey consisted of only 10 experts working in MAPNA Company. Although this number of respondents is sufficient for fuzzy MCDM [6], [13], [14] researches, it is important to emphasize that the results of this study cannot be generalized for other organizations, regions, and even types of projects.

II. It should be mentioned that the study under discussion concentrated only on industrial construction projects. This limitation suggests that the conclusions obtained might not be appropriate for residential, commercial, and infrastructure construction projects.

III. The criteria concerning composite materials in general were determined using existing literature and experts' opinions, but were not empirically tested using long-term cases. It means that it is still unknown what influence such criteria might have on construction project management processes.

IV. The research was conducted through a static MCDM model of fuzzy logic. The importance of success factors as well as their interactions might change during the various stages of the life cycle of a project (initiation, planning, implementation, and termination).

V. The judgments made by the experts were subjective, although the use of fuzzy logic reduced uncertainties related to this problem. The performance of completed projects can be considered in further studies.

5.7 | Recommendations for Future Research

Some of the avenues for future research that arise from the constraints discussed earlier include the following. Firstly, cross-national analysis through comparative research of success factors amongst various EPC contractors across different nations can provide further insights into how cultural factors, regulatory frameworks, and national markets affect the relative priorities of success factors.

An example of cross-country analysis involving Iran, Turkey, and the United Arab Emirates (UAE) can be useful to explore. Secondly, future research can conduct longitudinal case studies of various EPC contracts to measure and analyze whether the identified success factors accurately predict contract success in practice.

Ex-post data about the cost overrun, schedule slippage, and quality deviation in projects that have performed well according to top-priority success factors (e.g., construction regulation, customer influence, accreditation) will allow such predictions to be made. Thirdly, future research can adopt a dynamic MCDM framework by developing a model that allows for the criteria weights and relationships to change across project phases.

Fourth, the combination of objective performance measures (for example, earned value management information, safety incidents, non-conformance) along with subjective evaluations by experts can help eliminate bias and increase model reliability. Potential areas of development include hybrid models that incorporate DEA and machine learning with fuzzy MCDM.

Fifth, given the increasing use of composites, specialized investigations into successful project factors should be conducted. Research into composite-focused supply chains and durability, as well as cost comparisons of composite and traditional material projects, is necessary.

6 | Conclusion

This research proposed a new hybrid approach to integrate Fuzzy DEMATEL with ANP to optimize the industrial construction project success at MAPNA Company. It has been shown that the model has successfully provided seven main criteria and forty-five sub-criteria, examined their causal-effect relationship, and ranked them according to their priority. Some of the major outcomes include the following: 1) project management is the most critical criterion as a "cause", 2) the ranking of main criteria shows that those related to the Contractor have higher importance than the other categories, 3) construction regulations, customer influence and certification of products/services rank first to third in all sub-criteria categories, and 4) the special criteria concerning the Composite Material such as certification of its products/services, manufacturing process, supply chain reliability, and durability have been successfully considered in the enhanced model. With the aid of the FDANP methodological framework, uncertainties and interrelationships can be managed efficiently. Considering the most critical factors identified by this study would lead to allocating the available resources optimally and, hence, to the success of construction projects.

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