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The Use of Efficient Decision-Making Techniques for Evaluating Key Success Indicators in Agile Project Management (A Case Study of Mapna Company)

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A B S T R A C T

Agile project management is an iterative and collaborative approach that breaks down larger projects into smaller, manageable tasks called sprints or iterations. This method emphasizes flexibility and allows teams to respond to changing requirements while delivering work products incrementally. By fostering close collaboration and focusing on value delivery, agile project management helps teams effectively respond to challenges and changes throughout the project lifecycle. However, the success of implementing agile management depends on various factors that require intra-organizational and inter-organizational collaboration and coordination. In this regard, twelve variables were used as key success indicators in agile project management for the engineering team of Mapna Company. Using the best-worst method, the results revealed that project definition processes, team building, and management strategies were the most influential indicators. These were followed by market agility and concurrent engineering indicators. It is worth mentioning that process agility, information technology agility, information technology management, the use of knowledgeable and creative individuals, hardware, and virtual organizations had the least impact. In other words, project definition processes were found to be the most important criteria, while virtual organization indicators were found to be the least important in the success of agile project management at Mapna Company.

Keywords: *Agile project management, project success, best-worst method, information technology, team building.*

1. Introduction

In today's competitive and dynamic era, organizations can no longer sustain themselves with traditional methods. Projects, as the primary tools for responding to rapid environmental changes, increasing productivity, and improving performance, have gained a significant position within the organizational structure. However, the growing complexity of projects, along with the pressure to complete them faster, cheaper, and with higher quality, has posed challenges for organizations. One of the key questions is how to select appropriate projects and successfully complete them. Since the 1980s, project management standards have been developed to increase project success; however, these standards have always required revisions and improvements. One of the modern approaches is "Agile Project Management," which emphasizes regular reviews, breaking down projects into smaller sections, adapting to changes, and increasing interaction with stakeholders. This approach has gained widespread application in dynamic environments such as software development and innovative industries, and is considered by researchers as one of the most successful project management methods due to its focus on performance and flexibility (Pour Moeini, 2023).

In the current landscape, organizations face widespread challenges such as technological changes, resource reductions, globalization, and competitiveness (Bibby & Dehe, 2018; Sharma, 2017; Wagire et al., 2021). Although technological advancements can lead to benefits such as increased productivity and better customer interactions, their adoption is accompanied by barriers including organizational, economic, and legal obstacles. To overcome these barriers, "open innovation" and participatory resource management can be instrumental. However, if the performance of project teams is not properly managed, the success of projects will be jeopardized (Anes et al., 2023). In this regard, Agile Project Management plays a crucial role in increasing the project success rate by providing a better response to changes, especially in the construction sector. This approach, by breaking projects into smaller tasks, ensuring continuous control, and reacting quickly to deficiencies, enables the achievement of successful projects within specified time and budget constraints (Aref, 2022; Pour Moeini, 2023).

The literature review indicates that agility in project management is a multi-dimensional concept that can be implemented differently depending on the industrial, cultural, and technological contexts. Rasnacis and Berzisa (2017) identified over 20 agile methods and found their adaptability to depend on the characteristics of the project, company, and employees. They highlighted the importance of human factors, such as motivation, interactions, and team compatibility with agile methods, in the success of their implementation (Rasnacis & Berzisa, 2017). Albuquerque et al. (2020), through case studies in three construction design companies in Brazil, found limited use of agile and lean approaches in the field, with a pessimistic attitude toward these changes being one of the barriers to their implementation (Albuquerque et al., 2020). Aref (2022) examined agile strategies for change management in construction projects, identifying customer participation, continuous improvement of resources, and flexible workflows as the most effective factors for dealing with changes (Aref, 2022). Leong et al. (2023) proposed a hybrid model of traditional and agile methods for the future sustainability of project management, emphasizing the simultaneous use of agile software development methods and classic methods to respond to digital transformation needs (Leong et al., 2023). Anes et al. (2023) developed a method for optimal allocation of agile teams in open innovation projects, improving team effectiveness by reducing execution time, and aiding decisions about using internal or external teams (Anes et al., 2023). Pozzi et al. (2023) identified key success factors such as continuous improvement, senior leadership, cross-functional team building, and project planning from case studies of Industry 4.0 implementation in Italy (Pozzi et al., 2023). Hassani-Moghadam et al. (2023) proposed a framework for agile organizational work process management, highlighting the balance between internal order and external disorder based on the "edge of chaos" theory (Hassani Moghadam et al., 2023). Habibi et al. (2023) found that agile practices had a positive and significant impact on organizational performance in their study of the management and planning organization of Qom (Habibi & Mousavi, 2023). Fatehi and Kiani (2023) explored the relationship between change management models and agile practices, concluding that organizations must have the necessary tools and skills to implement changes in order to enhance agility (Fatehi & Kiani, 2023). Tahanian et al. (2021) ranked agility factors in project-based organizations in Isfahan Municipality using a two-stage quality performance expansion, combining these factors with sustainability and project success indicators, emphasizing the importance of environmental considerations in agile practices (Tahanian & Etebari, 2022). Amini et al. (2020) used the Best-Worst Method to identify

and prioritize factors affecting cost increases in construction projects in Mashhad, aiming to improve design and execution processes to prevent cost overruns (Amini et al., 2020). Overall, the research background confirms that agility in project management is a concept that varies according to industrial, cultural, and technological contexts, with the key role of human resources, organizational characteristics, project structure, and technological tools as success factors or barriers in the path of agile transformation repeatedly validated in these studies.

The adoption of Agile methods is increasing in both public and private organizations. Many companies, including those during crises such as the COVID-19 pandemic, have leveraged the benefits of this approach in addressing unpredictable needs (Al Maamzi & Tawfik, 2022). One successful example in this field is Mapna Industrial Company. By implementing Agile project management in sectors such as energy, oil and gas, and rail transportation, the company has improved its responsiveness to market changes while enhancing the quality and delivery time of projects. Other advantages of using the Agile approach at Mapna include improved team collaboration, enhanced innovation, and increased operational productivity through dividing projects into smaller units and prioritizing them based on business value. These achievements have led to optimized resource allocation, reduced waste, and increased sustainability and profitability. However, challenges such as organizational resistance to change and difficulties in coordinating large-scale projects remain as barriers to fully implementing this approach.

Given the relative successes and existing challenges, the present study aims to identify and prioritize key success indicators in Agile Project Management at Mapna using the "Best-Worst" decision-making approach. This research seeks to answer the main question: How can key success indicators in Agile project management be evaluated at Mapna?

2. Methods and Materials

This research is descriptive-survey in nature and applied in its approach, conducted with the aim of evaluating key success indicators in Agile project management at Mapna Company. For data collection, 21 indicators were initially identified based on previous studies. Then, using the Delphi method and with the participation of 10 Mapna managers, the indicators were refined, and finally, 12 main indicators were confirmed. Sampling was performed using the snowball sampling method, and a 9-point Likert scale questionnaire was utilized. For data analysis, the Best-Worst Method (BWM) introduced by Rezaei (2015) was used. This method, through pairwise comparisons and an optimal mathematical model, extracts the weights of criteria with high accuracy and low error. The statistical population of the study included experts in the field of projects at Mapna Company, and no sampling was performed; instead, 15 experts were purposefully selected. The research steps included a literature review, refinement of indicators, design and distribution of the questionnaire, data collection, and final analysis. To assess the consistency in comparisons, the CR index was calculated based on the maximum error ξ, and the CI index was computed.

3. Findings and Results

One of the most important sections of any research is the analysis of data. Any errors or mistakes in this section can lead to incorrect conclusions. The data collected are raw sources that need to be analyzed by appropriate tools to make their results applicable. In Chapter 3, the research method was discussed; therefore, in this chapter, the final indicators and criteria related to the factors influencing the use of efficient decision-making techniques for evaluating key success indicators in Agile project management, derived and validated using the research literature and expert opinions, are ranked and introduced using the Best-Worst Method and Kolmogorov-Smirnov, t-test, and Friedman tests based on chi-squared ranking. It is worth noting that the experts examined were from the statistical population of active project experts at Mapna Company. Accordingly, 12 factors affecting the use of efficient decision-making techniques for evaluating key success indicators in Agile project management were identified, as presented below:

- Team Building
- Market Agility
- Hardware
- Process Agility
- Information Technology Agility
- Virtual Organization
- Project Definition Processes
- Information Technology
- Project Management
- Use of Knowledgeable and Creative Individuals
- Concurrent Engineering
- Management Strategies

33.3% of the statistical sample, consisting of active project experts at Mapna Company, were women, while 66.7% were men.

20% of the individuals were between 30 to 35 years old, 33.3% were between 40 to 45 years old, and 46.7% were between 45 to 50 years old.

40% of the individuals held a master's degree, while 60% held a PhD or higher. The largest educational group among the statistical population consisted of individuals with a PhD or higher.

40% of the individuals had 10 to 15 years of work experience, 46.6% had 15 to 20 years of work experience, and 13.4% had more than 20 years of experience. Based on the table below, most individuals had work experience between 15 to 20 years.

This section provides descriptive statistics for the research variables. These indicators include: mean, standard deviation, minimum, maximum, range, skewness, kurtosis, and variance. Based on the obtained values, the highest mean and highest variance among the indicators will be identified. The descriptive statistics for these indicators are presented in Table 1:

Table 1

Descriptive Statistics of Research Variables

Variable	Mean	Standard Deviation	Skewness	Kurtosis	Variance
Team Building	2.47	1.246	0.471	-0.520	1.552
Market Agility	3.67	0.976	-0.276	-0.646	0.952
Hardware	3.60	1.298	-0.705	-0.637	1.686
Process Agility	2.47	1.407	0.610	-0.647	1.981
IT Agility	3.07	1.668	-0.014	-1.692	2.781
Virtual Organization	2.93	1.280	0.377	-1.273	1.638
Project Definition Processes	3.27	1.335	-0.355	-0.783	1.781
Information Technology	3.20	1.656	-0.257	-1.592	2.743
Project Management	3.00	1.558	0.000	-1.347	2.429
Use of Knowledgeable and Creative People	2.40	1.682	0.719	-1.336	2.829
Concurrent Engineering	2.87	1.302	0.505	-0.378	1.695
Management Strategies	2.87	1.407	0.270	-0.916	1.981

As shown in Table 1, the highest mean corresponds to the Market Agility indicator with a value of 3.67, while the lowest mean corresponds to the Use of Knowledgeable and Creative People indicator with a value of 2.40 among the considered indicators. Additionally, the most significant variance indicator, for the Use of Knowledgeable and Creative People, has the highest value of 2.829, while the lowest variance value corresponds to the Market Agility indicator with 0.952.

The normality test was conducted to assess the distribution of variables. According to the results presented in Table 2, based on the Kolmogorov-Smirnov test, all variables are normally distributed, and the null hypothesis (H0) is confirmed.

Table 2

Kolmogorov-Smirnov Normality Test

Variable	Distribution Type	Sig Level (p-value)	K-S Value	Hypothesis Confirmation
Team Building	Normal	0.20	0.179	H0: Normal
Market Agility	Normal	0.27	0.234	H0: Normal
Hardware	Normal	0.06	0.288	H0: Normal
Process Agility	Normal	0.180	0.185	H0: Normal
IT Agility	Normal	0.730	0.210	H0: Normal
Virtual Organization	Normal	0.05	0.300	H0: Normal
Project Definition Processes	Normal	0.200	0.175	H0: Normal
Information Technology	Normal	0.130	0.195	H0: Normal
Project Management	Normal	0.200	0.167	H0: Normal
Use of Knowledgeable and Creative People	Normal	0.06	0.264	H0: Normal
Concurrent Engineering	Normal	0.079	0.259	H0: Normal
Management Strategies	Normal	0.127	0.196	H0: Normal

The t-test is used to determine the significant difference between the mean of a group and a predefined value or between the means of two groups. The results are presented in Table 3.

Table 3

T-Test Results

Variable	T-Value	Sig Level (p-value)	Mean Difference	95% Confidence Interval Min	95% Confidence Interval Max
Team Building	7.668	0.001	2.467	1.78	3.16
Market Agility	14.552	0.001	3.667	3.13	4.21
Hardware	10.739	0.001	3.600	2.88	4.32
Process Agility	6.788	0.001	2.467	1.69	3.25
IT Agility	7.122	0.001	3.067	2.14	3.99
Virtual Organization	8.876	0.001	2.933	2.22	3.64
Project Definition Processes	9.480	0.001	3.267	2.53	4.01
Information Technology	7.483	0.001	3.200	2.28	4.12
Project Management	7.456	0.001	3.000	2.14	3.86
Use of Knowledgeable and Creative People	5.527	0.001	2.400	1.47	3.33
Concurrent Engineering	8.527	0.001	2.867	2.15	3.59
Management Strategies	7.888	0.001	2.867	2.09	3.65

As indicated in Table 3, the significant effect of all variables is confirmed at the 95% confidence level using the t-test. In fact, the hypothesis regarding the effect of all twelve indicators—team building, market agility, IT agility, process agility, hardware, virtual organization, project definition processes, information technology, project management, use of knowledgeable and creative individuals, concurrent engineering, and management strategies—on the use of efficient decision-making techniques for evaluating key success indicators in Agile project management has been confirmed.

Table 4

Friedman Test Based on Chi-Squared

Variable	Significance Level	Result
Team Building	0.615	Null Hypothesis (H0) is accepted
Market Agility	0.506	Null Hypothesis (H0) is accepted
Hardware	0.199	Null Hypothesis (H0) is accepted
Process Agility	0.504	Null Hypothesis (H0) is accepted
IT Agility	0.504	Null Hypothesis (H0) is accepted
Virtual Organization	0.070	Null Hypothesis (H0) is accepted
Project Definition Processes	0.856	Null Hypothesis (H0) is accepted
Information Technology	0.504	Null Hypothesis (H0) is accepted
Project Management	0.323	Null Hypothesis (H0) is accepted
Use of Knowledgeable and Creative People	0.269	Null Hypothesis (H0) is accepted
Concurrent Engineering	0.506	Null Hypothesis (H0) is accepted
Management Strategies	0.615	Null Hypothesis (H0) is accepted

Table 4 shows that the null hypothesis (H0) is accepted for the twelve research variables, including team building, market agility, IT agility, process agility, hardware, virtual organization, project definition processes, information technology, project management, use of knowledgeable and creative people, concurrent engineering, and management strategies, according to the expected frequencies. Therefore, a significant relationship exists between these indicators and the use of efficient decision-making techniques for evaluating key success indicators in Agile project management. Next, by implementing the Best-Worst approach in GAMS software, the final weights of the indicators will be determined. Based on this, the consistency index values for the variables are obtained in Table 5, and then the overall weights of the indicators are presented in

Table 6, along with their prioritization using the Best-Worst approach.

Table 5

Consistency Index (CI)

Indicator (a_bw)	Consistency Index (Highest ξ)
Team Building	0.425
Market Agility	1.102
Hardware	2.303
Process Agility	1.635
IT Agility	5.236
Virtual Organization	1.079
Project Definition Processes	2.332
Information Technology	3.415
Project Management	0.000
Use of Knowledgeable and Creative People	0.751
Concurrent Engineering	0.635
Management Strategies	4.121

Table 6

Final Weights of Indicators

Consistency Ratio (CR)	Indicator (a_bw)	Overall Weight	Rank
CR = 0.839	Team Building	0.112	2
	Market Agility	0.093	3
	Hardware	0.036	7
	Process Agility	0.092	4
	IT Agility	0.092	4
	Virtual Organization	0.013	8
	Project Definition Processes	0.156	1
	Information Technology	0.092	4
	Project Management	0.059	5
	Use of Knowledgeable and Creative People	0.049	6
	Concurrent Engineering	0.093	3
	Management Strategies	0.112	2

The results presented in Table 6 show the final weights for each of the indicators: team building, market agility, IT agility, process agility, hardware, virtual organization, project definition processes, information technology, project management, use of knowledgeable and creative people, concurrent engineering, and management strategies.

As shown in Table 9, the indicators related to project definition processes, team building, and management strategies were determined to be the most important criteria, while virtual organization and hardware were identified as the least important indicators using the Best-Worst method. Finally, after prioritizing the influential indicators, the results of the hypothesis testing will be discussed in Table 7.

Table 7

Hypothesis Testing Results

Row	Hypothesis	Result
1	Team building leads to the success of Agile projects at Mapna.	Hypothesis is confirmed
2	Considering market agility leads to the success of Agile projects at Mapna.	Hypothesis is confirmed
3	IT agility leads to the success of Agile projects at Mapna.	Hypothesis is confirmed
4	Process agility leads to the success of Agile projects at Mapna.	Hypothesis is confirmed
5	Implementing optimal hardware infrastructure leads to the success of Agile projects at Mapna.	Hypothesis is confirmed
6	Using a virtual organization leads to the success of Agile projects at Mapna.	Hypothesis is confirmed
7	Project definition processes lead to the success of Agile projects at Mapna.	Hypothesis is confirmed

8	Using information technology leads to the success of Agile projects at Mapna.	Hypothesis is confirmed
9	Project management leads to the success of Agile projects at Mapna.	Hypothesis is confirmed
10	Use of knowledgeable and creative people leads to the success of Agile projects at Mapna.	Hypothesis is confirmed
11	Concurrent engineering leads to the success of Agile projects at Mapna.	Hypothesis is confirmed
12	Optimized management strategies lead to the success of Agile projects at Mapna.	Hypothesis is confirmed

4. Discussion and Conclusion

The results of this study confirm that key success indicators in Agile project management within Mapna Company were aligned with several variables identified as essential in the existing literature. These variables include team building, market agility, IT agility, process agility, hardware, virtual organization, project definition processes, information technology, project management, use of knowledgeable and creative people, concurrent engineering, and management strategies. The confirmation of these variables as crucial for the success of Agile projects in Mapna is consistent with earlier findings in the field of project management and agile methodologies.

The present study's focus on team building as a key success indicator supports this view, aligning with the idea that successful Agile project management hinges on effective teamwork and continuous communication between the project team and stakeholders. Furthermore, the prominence of customer participation as an important factor in this study corroborates with findings from Aref (2022) who noted that collaboration and engagement with clients play a crucial role in managing changes in construction projects (Aref, 2022). The results underscore that the involvement of clients and stakeholders is a critical driver for success in Agile project management, especially in dynamic industries like construction.

Moreover, market agility emerged as another key factor, which is consistent with (Rasnacis & Berzisa, 2017) identification of agility as being dependent on project and organizational characteristics. They pointed out that the adaptability of agile methods depends on the specific features of the project and its context. The current study supports this perspective, where market agility was identified as an essential element for Agile project success, helping organizations to better adapt to changing market conditions and meet project requirements in a timely manner. This aligns with the findings (Pozzi et al., 2023), who also emphasized continuous improvement and adaptability in Agile project management for successful business operations in the context of Industry 4.0.

Another significant finding of this research is the role of IT agility and the use of technology in enhancing Agile project management. The results of this study confirm the positive impact of IT agility on project success, which resonates with Bhatia and Kumar's (2020) identification of governance and collaboration as key success factors in technological implementations. They observed that the successful adoption of new technologies is highly influenced by organizational structures and the ability to adapt to technological changes. In the context of Mapna, the integration of IT systems and software tools into project management was identified as a vital enabler for efficient project execution, as the flexibility and responsiveness of IT systems facilitated a quicker response to emerging challenges in projects.

Furthermore, the study also highlights the importance of process agility, which is echoed in the literature by researchers (Albuquerque et al., 2020), who emphasized that process agility is essential for successfully managing construction projects. Their findings suggested that limited application of agile and lean methods in construction is a major obstacle to project success. Similarly, this study found that process agility, when well-integrated into the project, leads to better workflow management and the ability to adapt to unforeseen challenges during the project lifecycle. This further supports the view that agile methodologies, when applied to construction projects, provide valuable flexibility, contributing to the successful completion of complex projects in a dynamic environment.

The study also found that concurrent engineering, the use of knowledgeable and creative individuals, and management strategies were essential to the success of Agile projects at Mapna. This aligns with the findings of (Leong et al., 2023), who proposed a hybrid model of traditional and Agile methods to enhance sustainability and address the digital transformation challenges in project management. Their approach suggests that the combination of Agile and traditional methods can lead to more robust management strategies, capable of addressing both operational efficiency and strategic long-term goals. In line with this, the study confirms that adopting a strategic approach that integrates Agile methods with existing frameworks significantly

improves project outcomes, particularly in industries where technological and operational demands are high.

The role of virtual organizations in enabling Agile project success is another noteworthy finding of this research, supporting the work of (Rasnacis & Berzisa, 2017), who found that the alignment of team characteristics with Agile methods was crucial for effective implementation. The virtual organization model, which relies on flexible and remote working arrangements, was found to contribute positively to the success of Agile projects in Mapna. This observation aligns with earlier studies (Aref, 2022; Pozzi et al., 2023), who emphasized the role of cross-functional teams and flexible organizational structures in enhancing Agile project management.

In conclusion, the findings of this study are consistent with the broader body of research on Agile project management. The results confirm that team building, market agility, IT agility, process agility, project definition processes, and management strategies are critical success factors in implementing Agile methodologies, particularly in industries like construction, energy, and technology. These findings contribute to the growing body of literature on the application of Agile methods in diverse project environments, offering practical insights into how organizations like Mapna can leverage Agile practices for better project outcomes.

While this study provides valuable insights into the success factors of Agile project management at Mapna, several limitations should be noted. First, the study was conducted within a specific organizational context, which limits the generalizability of the findings to other industries or organizations with different operational structures and project types. Second, although the research used a robust Delphi process to refine the success indicators, the subjective nature of expert opinions may introduce some bias. The study's reliance on the Best-Worst Method, while a powerful tool for prioritizing indicators, may also be influenced by the assumptions made during the weight assignment process. Additionally, the study only considered a limited set of indicators; other factors, such as organizational culture and external environmental conditions, may also influence the success of Agile project management but were not fully explored in this research. Lastly, the sample size, although purposeful, was relatively small, which may affect the robustness of the conclusions drawn.

Future research should aim to explore the applicability of Agile project management in different organizational contexts, including small and medium-sized enterprises (SMEs) and industries outside construction, such as manufacturing or healthcare. It would be valuable to conduct cross-industry studies to compare the success factors and challenges faced by organizations in adopting Agile practices. Additionally, further research could focus on understanding the long-term impacts of Agile project management on organizational performance, particularly in terms of cost-effectiveness, quality, and customer satisfaction. Another avenue for future research could involve exploring the role of advanced technologies, such as artificial intelligence and machine learning, in enhancing Agile project management practices and decision-making processes. Lastly, studying the effects of cultural and geographical factors on the adoption and success of Agile practices could provide valuable insights into how different regions approach Agile methodologies.

Organizations looking to adopt or improve their Agile project management practices should prioritize team building and ensure that project teams are well-integrated, with clear communication channels and a collaborative mindset. Providing training and development opportunities for team members in Agile methodologies can significantly enhance team performance. Furthermore, companies should focus on developing flexible IT infrastructures that can support the dynamic needs of Agile projects, enabling real-time collaboration and quick adaptation to changing requirements. It is also crucial to foster a culture of continuous improvement, where feedback from stakeholders, including customers, is actively sought and incorporated into project processes. Finally, organizations should consider implementing hybrid management strategies that combine the strengths of traditional and Agile approaches, allowing for a more adaptive and sustainable project management framework.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were considered.

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