Article Type: Case Study

OPEN ACCESS

Assessing Employee Satisfaction in Civil Project Success Using AHP: A Case study

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Received: 29 October 2024 / Accepted: 10 December 2024 / Published: 19 December 2024

***Abstract*:** This study investigates the relationship between human resource satisfaction factors and the success of civil projects. The research targeted a population of 220 senior managers, executives, and experts involved in the company's construction projects, selecting a sample of 140 participants based on Morgan's table. Using a descriptive-survey approach, seven primary criteria were identified: execution ability, psychological commitment, reward level, specialization, management style, productivity improvement factors, environmental considerations, each encompassing various sub-criteria. A hierarchical model was developed and implemented using ExpertChoice 11 and Excel software to evaluate these factors. The findings indicate that operational capability is the most critical criterion, accounting for 48.6% of the priority weighting, highlighting its dominant role in project success. The second most significant factor is psychological content (17.6%), emphasizing the need to address the emotional and mental well-being of personnel alongside operational efficiency. In contrast, productivity enhancement factors received the lowest priority (2.4%), reflecting their limited impact on employee satisfaction in this context. The results underscore the importance of aligning human resource strategies with operational and psychological needs to improve project outcomes. This study provides actionable insights for enhancing satisfaction and performance within construction projects in regional utility companies.

Keywords: Project success, Civil projects, Human resources, Employee satisfaction.

I. INTRODUCTION

Civil projects are a cornerstone of development for any society or country. These projects encompass a wide range of initiatives, from small-scale to large-scale endeavors, contributing to national progress and improving the quality of life for citizens (Chileshe & Haupt, 2010). Examples include building construction, residential complexes, road construction, paving, dam construction, tunnels, bridges, treatment plants, airports, and more. Such projects shape the identity of a country or city, reflecting its growth and ambitions. Many organizations face challenges such as a lack of available talent, weak retention strategies for top talent, and ineffective human resource management policies, including inadequate compensation and benefits (Stefanovska-Petkovska et al., 2017). Due to intense competition and limited resources, prioritizing the training and well-being of skilled human resources has become critical for project management in the country (Diani & Heydariyeh, 2019). The most valuable resource in ensuring the success of civil projects is human capital. Therefore, human resource satisfaction plays a pivotal role in achieving project success (Solehsour & Farooji, 2011). This highlights the necessity of aligning project strategies with the needs and expectations of the workforce to ensure sustainable and impactful outcomes.

There is no doubt that employees are the most valuable resource of any organization. Employees with high job satisfaction, regardless of their job title or salary, tend to have significantly higher productivity. Keeping employees satisfied and secure leads to positive outcomes for both the organization and its workforce. Key reasons why job satisfaction is critical include increased profitability, improved customer satisfaction, reduced employee turnover, enhanced productivity, and greater employee loyalty (Hafeez et al., 2002). In the context of civil project success, numerous factors contribute to positive outcomes, with human resources and employee satisfaction being among the most critical. Passion for work and a positive attitude among employees play a vital role in ensuring operational and executive progress in various projects (Khan et al., 2015). Understanding the human factors that closely relate to the success of civil projects is essential for organizational growth. Satisfied employees are vital to the success of any company. Organizations must ensure their employees are happy and satisfied to such an extent that competitors cannot lure them away (Temel, 2023). This, in turn, significantly influences the company's progress in diverse areas, particularly in field development and infrastructure projects (Welfare et al., 2011).

Employee satisfaction is a cornerstone of success in the construction industry and infrastructure projects. Satisfied employees are more engaged, motivated, and productive, which directly impacts project timelines, quality, and overall efficiency.

In a field where projects are often complex, time-sensitive, and resource-intensive, the role of a happy and committed workforce becomes even more critical (Stefanovska-Petkovska et al., 2017). High levels of satisfaction foster a sense of ownership among employees, encouraging them to go above and beyond to achieve project goals. In the construction industry, where teamwork is vital, employee satisfaction enhances collaboration and communication on-site and within teams. Workers who feel valued and appreciated are more likely to communicate openly, address challenges collaboratively, and share innovative ideas (Mustafi et al., 2014). This environment of mutual respect and cooperation reduces the likelihood of errors, misunderstandings, and conflicts, leading to smoother project execution. A satisfied workforce also fosters a culture of trust, which is essential for handling the high-pressure situations that often arise in construction projects (Chileshe & Haupt, 2007). Safety is another area where employee satisfaction has a profound impact. When employees feel supported and appreciated, they are more likely to adhere to safety protocols and guidelines, reducing the risk of accidents and injuries. A company that prioritizes employee satisfaction often invests in comprehensive safety training and equipment, which not only protects its workers but also minimizes project delays caused by workplace incidents (Fugar et al., 2019). This proactive approach enhances the company's reputation, attracting more skilled professionals and securing future projects.

Employee satisfaction is also crucial in retaining talent in the construction industry, where skilled labor shortages are a common challenge. Losing experienced workers can disrupt projects and lead to costly delays. By maintaining high satisfaction levels, companies can reduce turnover rates and build a stable, experienced workforce. Retaining employees also saves on the cost and time associated with recruiting and training new hires, ensuring continuity and consistency in project delivery (Harding, 2013). Satisfied employees contribute to the long-term sustainability of infrastructure projects. Infrastructure development often requires meticulous planning, execution, and maintenance, all of which depend on a reliable and committed workforce. When employees feel their contributions are recognized, they take pride in their work, resulting in higher-quality outcomes. This commitment to excellence not only ensures project success but also builds public trust in the company's ability to deliver durable and sustainable infrastructure, securing its position in a competitive market (Louca & Kamsaris, 2013).

Achieving satisfaction requires measurable metrics to assess and improve it. Identifying the factors that directly or indirectly impact the success or failure of a civil project can provide critical insights for improving project execution and management (Aiyewalehinmi, 2013). This article aims to evaluate the impact of human resource satisfaction on the success of civil projects within the Regional Electricity Company of Mashhad. By understanding these dynamics, the study seeks to contribute to the development of effective strategies for enhancing project outcomes through better human resource management. The necessity of this study stems from the critical role employees play in the success of civil and infrastructure projects. While many organizations focus on technical and financial aspects of project execution, the importance of employee satisfaction is often overlooked, despite its direct impact on productivity, teamwork, and project outcomes. Given the challenges in the construction industry, such as intense competition, resource limitations, and the need for skilled labor retention, understanding and addressing the factors that influence employee satisfaction is essential. This study provides a targeted approach by analyzing the relationship between employee satisfaction and project success using a systematic and measurable framework, which is particularly relevant in the context of the Regional Electricity Company of Mashhad. The novelty of this research lies in its integration of the AHP method to evaluate the specific factors influencing employee satisfaction and their prioritization within civil projects. By identifying key criteria such as operational capability, psychological well-being, and management style, the study offers a structured methodology for assessing and enhancing workforce satisfaction. Unlike traditional studies that provide generalized insights, this research presents a focused case study, enabling actionable recommendations tailored to the unique challenges of the construction industry. The findings not only contribute to academic knowledge but also offer practical implications for improving employee strategies, ultimately driving the success of infrastructure projects in similar organizational contexts.

II. Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) is a structured decision-making methodology that helps prioritize and evaluate multiple factors, especially when dealing with complex decisions involving numerous criteria (Ho, 2008). Developed by Thomas L. Saaty in the 1970s, AHP uses a hierarchical structure to break down a problem into its constituent elements, enabling systematic analysis and comparison. It employs pairwise comparisons to quantify preferences among criteria and sub-criteria, assigning a relative weight to each factor based on its importance (Vaidya & Kumar, 2006). This approach ensures a logical and consistent evaluation process, particularly for problems where subjective judgments play a significant role (Ishizaka & Labib, 2011). In the construction industry, AHP is especially valuable because of the multifaceted nature of decisions that professionals encounter. From resource allocation and contractor selection to project risk management and sustainability planning, construction projects often require balancing competing priorities (Sipahi & Timor, 2010).

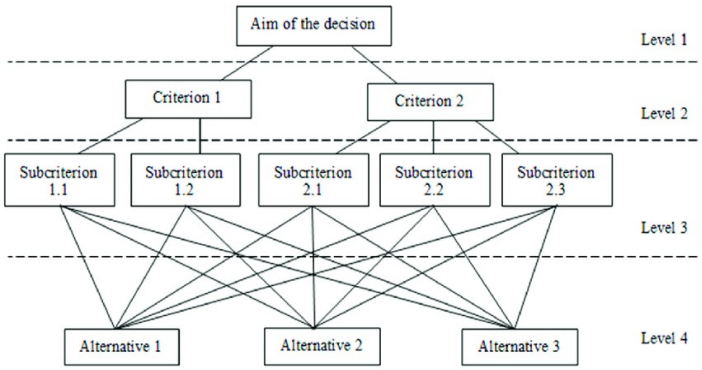

Fig. 1 A view of general arrangement for AHP model (Ishizaka & Labib, 2011)

AHP allows stakeholders to consider both qualitative and quantitative factors, providing a clear framework to evaluate trade-offs and align decisions with project objectives. Its ability to synthesize input from various stakeholders ensures that diverse perspectives are incorporated into the decision-making process, leading to more informed and balanced outcomes (Vaidya & Kumar, 2006). One of the key strengths of AHP in construction is its capacity to simplify complex problems, such as evaluating project success factors or prioritizing tasks within a constrained budget. By assigning weights to criteria like cost, time, quality, and safety, AHP helps project managers make decisions that align with strategic goals (Sipahi & Timor, 2010). This structured approach reduces the likelihood of bias or oversight, ensuring that critical factors are given appropriate attention. In an industry where even minor misjudgments can lead to costly delays or disputes, AHP provides a robust tool for minimizing risks (Darko et al., 2019).

AHP can also be instrumental in assessing and improving employee satisfaction, a critical determinant of civil project success. Employee satisfaction involves numerous interrelated factors, such as job security, work environment, compensation, recognition, and career development opportunities. Using AHP, these factors can be systematically ranked based on their impact on employee morale and productivity. This analysis enables managers to prioritize initiatives that address the most pressing concerns of their workforce, fostering a motivated and engaged team (Cakmak & Cakmak, 2014). Incorporating AHP into employee satisfaction strategies offers construction firms a measurable way to align workforce needs with organizational objectives. For instance, if AHP reveals that operational capability and psychological well-being are the most critical factors for employee satisfaction, project managers can focus on improving these areas. This might involve providing better training programs, creating a positive work culture, or offering mental health support. Such targeted interventions not only boost satisfaction but also enhance overall project performance by reducing absenteeism and turnover (Darko et al., 2019). Ultimately, the application of AHP in influencing employee satisfaction for civil project success underscores its value as a comprehensive decision-making tool. By identifying and addressing the most impactful satisfaction factors, organizations can cultivate a workforce that is more committed, productive, and aligned with project goals. This synergy between employee well-being and project management ensures not only the successful execution of civil projects but also the long-term sustainability and growth of the organization.

In today's complex environment of large-scale construction projects, the needs and perspectives of all stakeholders are often overlooked. Project-oriented organizations utilize project management knowledge to achieve strategic goals. Given the involvement of diverse stakeholders in large construction projects, understanding their importance is crucial. Identifying and prioritizing key stakeholders is vital for project success, as they significantly influence the project's time, cost, and quality. Significant criteria impacting construction projects have been identified both locally and internationally and ranked by importance using multi-criteria decision-making methods (Belbasi & Keshteli, 2015). The AHP has emerged as a potential decision-making tool for project management (Erdogan et al., 2017). AHP employs a hierarchical structure to evaluate capabilities and prioritize factors, offering a clear and systematic framework for decision-making. It can be applied to rank contractors based on predefined criteria, generating a descending list of options to select the most suitable contractor for the project (Doloi, 2008). Moreover, sensitivity analysis within AHP allows decision-makers to assess how slight changes in judgments can impact the final decision (Lin et al., 2008). AHP focuses on deriving relative quantities of importance among given options, emphasizing the balance between the decision-maker's intuitive judgments and logical consistency in pairwise comparisons. This compatibility with human decision-making behavior makes AHP an effective and user-friendly method (Vaidya & Kumar, 2006).

A key strength of AHP is its ability to integrate both tangible and intangible factors into a systematic approach, simplifying complex decision-making problems. By breaking down a large issue into smaller, more manageable components through logical hierarchical structures, AHP enables decision-makers to connect micro-level judgments to macro-level solutions through pairwise comparisons (Prascevic & Prascevic, 2017). However, uncertainty in preference judgments can increase ambiguity in prioritization and challenge logical consistency (Skibniewski & Chao, 1992). This limitation has led to the development of the fuzzy AHP method. Fuzzy AHP extends traditional AHP by incorporating triangular fuzzy numbers to address ambiguity in hierarchical problems. Based on responses from decision-makers, fuzzy values replace uncertain data, and pairwise comparison matrices are generated at each hierarchical level. Using fuzzy logic, intersection points are calculated for each comparison, and membership values are weighted accordingly (Taylan et al., 2014). After defining the criteria, questionnaires are designed to quantify the relative importance of these factors (Erdogan et al., 2019). By addressing uncertainty and improving consistency in decision-making, fuzzy AHP offers a more robust framework for evaluating and prioritizing factors in construction projects. This method enhances traditional AHP's applicability in complex, ambiguous scenarios, ensuring more accurate and reliable outcomes for project managers and stakeholders alike.

III. Materials and Methods

This research is an applied study that utilizes a descriptive-survey method. The study aims to explore the influence of employee satisfaction on the success of construction projects. To achieve this goal, the research follows two main aspects: the first being a field analysis approach based on descriptive-survey methods, and the second being the application of the AHP to analyze the gathered data. This combination allows for both theoretical exploration and practical, data-driven decision-making in the context of construction project management. For this research, data will be gathered through both theoretical and field-based methods. The theoretical data collection will involve reviewing existing literature, including books, research articles, academic journals, and online databases that are relevant to the topic of employee satisfaction and construction project success. This will provide a strong foundation of theoretical knowledge and previous research findings. In addition, primary data will be collected through field studies, which will include interviews and

surveys with industry experts, project managers, and employees in the construction sector. This combination of theoretical and field-based data collection methods ensures that the study is both comprehensive and grounded in real-world practices.

The desk study method will be the first step in gathering information related to the theoretical background of the study. A thorough review of existing literature, including books, academic papers, and case studies, will help establish a solid understanding of the foundational concepts surrounding employee satisfaction, project management, and construction industry dynamics. By examining the work of other scholars and experts, the researcher will identify knowledge gaps and build upon existing theories. The data obtained from books, academic journals, and online resources will provide the necessary context for understanding how employee satisfaction influences project outcomes in the construction sector. In the field-based phase, the researcher will utilize surveys and interviews as the primary tools for data collection. A well-structured questionnaire will be developed to assess various factors that contribute to employee satisfaction, such as execution ability, psychological commitment, reward level, specialization, management style, productivity improvement factors, environmental considerations. The questionnaire will be distributed to employees and contractors working in the construction industry, focusing on those involved in large-scale infrastructure projects. In addition to the survey, in-depth interviews will be conducted with key stakeholders, such as project managers and senior executives, to gather qualitative insights about the challenges and best practices related to employee satisfaction in the construction industry.

The AHP will be used to analyze the data collected from the surveys and interviews. AHP is a structured decision-making tool that helps prioritize criteria and evaluate alternatives based on expert opinions. In this study, AHP will be employed to assess the relative importance of various factors influencing employee satisfaction and to determine their impact on the success of construction projects. The AHP method will involve creating a decision matrix, where experts' judgments will be used to assign weights to different criteria. This approach will help quantify the impact of each factor on project success and guide decision-making. To apply the AHP method, expert opinions will be gathered through a specialized questionnaire. These experts will include senior managers, project managers, and other stakeholders who have extensive experience in the construction industry. The responses will be used to create a decision matrix that will quantify the importance of each factor related to employee satisfaction. By comparing the various criteria in pairs, the AHP model will help determine which factors have the greatest influence on employee satisfaction and, by extension, the success of construction projects. This process will ensure that the findings are based on real-world expertise and provide actionable insights.

Once the initial decision matrix has been established and the factors have been prioritized, a sensitivity analysis will be conducted to assess the robustness of the results. This analysis will test how changes in the input values (expert judgments) affect the overall prioritization. Sensitivity analysis is essential for understanding the stability of the decision-making process and ensuring that the results are reliable. By examining the effects of small changes in the input data, the researcher can identify any weaknesses in the model and make adjustments as necessary. This step will help ensure that the study's findings are both valid and reliable. Figure 2 is illustrating the process flowchart of the study.

The statistical population for this study includes employees and contractors from the Regional Electric Company of Mashhad, specifically those working on construction projects. The population will be divided into different groups, such as senior managers (deputies, advisors, and board members), senior executives (office managers, project managers), and senior experts (department heads and team leaders). The estimated total population is 135 individuals. A sample of 100 experts will be selected using Morgan's Table, which is a standard method for determining sample size in research studies. This sample will provide a representative group for gathering expert opinions and ensuring the validity of the research findings. For data analysis, the study will employ two primary software tools: ExpertChoice and Excel. ExpertChoice is a specialized software tool designed for AHP-based decision-making, and it will be used to process the decision matrices and calculate the impact coefficients. Excel will be used for data organization, basic statistical analysis, and visualizing the results. Together, these tools will allow for a thorough analysis of the collected data and the generation of meaningful results. The software tools will help streamline the process of analyzing complex data and ensure that the findings are presented in a clear and accessible format. The expected outcomes of this research include identifying the key factors that influence employee satisfaction in the construction industry and understanding their impact on the success of construction projects. The findings will offer valuable insights for project managers and organizations looking to improve employee satisfaction and project outcomes.

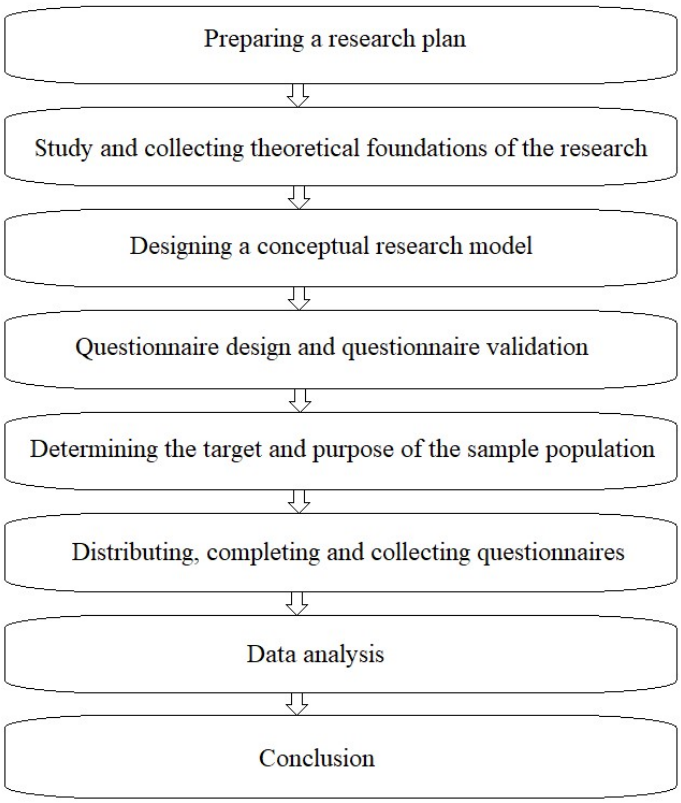

Fig. 2 Process flowchart of this study

Reliability

Warnings

No SCALE subcommand was found. Scaling will be done on all specified variables.

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	140	100.0
	Excluded[a]	0	.0
	Total	140	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.839	4

Fig. 3 Estimated Cronbach's alpha for this study

IV. Results and Discussion

The first step in descriptive-survey assessments involves gathering field data and classifying it based on the sample population. To achieve this, the characteristics and descriptive statistics of the expert group must first be identified, providing insights into the range and specialization of the experts involved in the analysis. Following this, the collected data is processed and analyzed. Statistical software or spreadsheet analysis tools, such as SPSS or Excel, can be used to process the questionnaire responses. The goal is to present the results in a summarized form, including relevant tables and charts, with the analysis based on these tables. Descriptive statistics will be employed to analyze the data and examine the demographic characteristics of the sample group. The questionnaire questions will be evaluated based on frequency, percentage, and average metrics. Data gathered from the research will be analyzed using inferential statistics with the assistance of Excel software. The processed data is presented in Table 1. It is worth noting that the descriptive statistics presented in this section, along with the criteria scoring to be discussed later, were implemented using Excel. Additionally, hierarchical modeling using AHP was conducted with ExpertChoice11 software, and the outputs will be displayed in Excel as part of analytical tables and charts. In descriptive statistical analysis, basic characteristics such as age, gender, education level, expertise, and work experience of the expert personnel are typically considered. These characteristics indicate the degree of centralization and the specialization of the experts involved in the analysis. As is well-known, statistical analyses often involve a wide range of specialists with diverse backgrounds and varying experiences. Therefore, the sample population selected for statistical analysis should be broad. However, expert-centered analyses, due to the specialized nature of the respondents, are usually conducted with smaller sample populations.

The advantage of specializing the respondent group for hierarchical analysis is that it minimizes the error in completing expert questionnaires. This reduction in error is clearly visible in the validity and reliability analysis of the data collection tools, which was discussed in the previous section. This approach ensures that the results are based on well-informed and specialized expert opinions, thereby enhancing the reliability and precision of the research findings. By utilizing expert input within a focused and small sample, the study maintains a high level of accuracy in the analysis, which is crucial for decision-making in complex scenarios such as construction project management.

Table 2 presents the results related to the outcomes of the evaluation (Phase 1) and design (Phase 2) stages, which represent the key factors evaluated in this study. The criteria and sub-criteria provided in this table serve as the basis for the assessments and simulations based on AHP methodology. Following this, considering the indices outlined in the table, AHP evaluation questionnaires were developed. The questionnaire was completed by expert personnel from the sample population, and their responses were incorporated into the modeling process using a descriptive-survey approach. As outlined in the previously, the AHP model has been implemented using ExpertChoice11. This software is one of the most widely recognized and commonly used tools for risk management and hierarchical decision-making analysis. It is widely utilized by researchers and professionals in the field across the world. This integration allows for effective presentation and analysis of the results, ensuring clarity and precision in decision-making processes, which are crucial in construction project management.

Table 1 Descriptive statistics of the sample population

Characteristics	Sample number	Frequency (%)
Gender Specification		
Men	100	71.42
Women	40	28.58
Age Specification		
25 – 30	15	10.71
31 – 35	18	12.85
36 – 40	42	30.00
41 – 45	49	35.00
45<	16	11.42
Education		
A-level Diploma	2	1.42
Bachelor's Degree	43	30.71
Master's Degree	83	59.28
PhD	12	8.57
Work Experience		
2>	10	7.14
2 – 5	15	10.71
5 – 10	33	23.57
10 – 15	60	42.85
15<	22	15.71
Career Positions		
Project Manager	20	14.29
HR Manager	30	21.42
Employee	60	42.88
Site Supervisor	13	9.27
Affiliate Contractor	17	12.14

Table 2 Criteria and subcriteria examined in this study

No.	Criterion	Sub-Criterion	Description	Nature
1	Execution ability (G1)	Understanding the general project conditions (M1)	Indicator employee should be able to gain a general overview of the project	Operational and Executive
		Ability to implement project strategies (M2)	Employee should be able to see the final goal and have the ability to implement it	
		Ability to manage and direct (M3)	Employee should be able to work autonomously and continuously	
		Ability to optimize human resource management (M4)	Employee should use available resources in a categorized, efficient, and option-oriented manner	
		Interactive ability between managers and resources (M5)	Employee should continuously maintain a two-way, effective communication with managers	
2	Psychological Commitment (G2)	Achieving a motivational level for work (M6)	Employee should reach a level of mental productivity (performance and enthusiasm) to implement the work	Human and Individual
		Achieving mutual understanding of execution and management (M7)	Employee should be mentally prepared to accept and carry out the work	
		Building identity and work loyalty (M8)	Employee should be responsible and loyal to the work they are engaged in	
3	Reward Level	Material value of achievements (M9)	Employee should be aware of the level of rewards and compensation they receive	Organizational and Managerial
		Understanding the importance of specialization in rewards (M10)	Employee should be aware of the compensation for specialized staff and pursue the reasons based on competency	
		Adherence to organizational rules (M11)	Employee should familiarize themselves with the execution process and organizational rules before taking responsibility for the project	
		Organizational financial support for individuals (M12)	Employee should continuously receive financial support within the framework of the contract	
4	Specialization (G4)	Familiarity with the nature and responsibilities of the job (M13)	Employee allocated to the project should not only be compatible with each other but also aware of the work's nature and the required competencies	Operational and Executive
		Collaboration with specialized personnel (M14)	Employee should collaborate with specialized staff such as engineers, inspectors, and supervisors	
		Receiving necessary training (M15)	Employee should continuously receive the necessary training during project execution	
		Continuous and optimized communication (M16)	Employee should maintain competent communication with specialists to implement the project	
5	Management Style (G5)	Interaction with Middle Managers (M17)	Employee should effectively interact with middle managers.	Managerial
		Interaction with Senior Managers (M18)	Employee should effectively interact with senior managers.	
		Interaction with Executive Directors (M19)	Employee should effectively interact with executive directors.	
		Interaction with Project Managers (M20)	Employee should effectively interact with project managers.	
		Communication between Managers and the Organization (M21)	Employee should maintain effective and seamless interaction with the organization and among managers.	
6	Productivity Improvement Factors (G6)	Continuous Project Progress Assessment (M22)	Employee should establish a consistent network to monitor project progress at regular intervals.	Operational and Executive
		Continuous Staff Performance Evaluation (M23)	Employee should establish a consistent system to assess staff performance at regular intervals.	
		Continuous Efficiency Assessment (M24)	Employee should set up a consistent network to evaluate the efficiency of operational, specialized, and general personnel at regular intervals.	
7	Environmental Considerations (G7)	Adherence to HSE Principles (M25)	Employee should be well-versed in HSE (Health, Safety, and Environment) principles and implement them effectively.	National and Regional
		Commitment to and Implementation of Sustainable Development (M26)	Employee should possess a strong understanding of and commitment to sustainability and environmental protection practices.	
		Receiving HSE Training (M27)	Employee should receive updated and relevant training in HSE-related topics.	
		Motivational Environmental Interactions (M28)	Employee should be individually and collectively aware of the significance of environmental resources and adopt approaches to enhance them.	

The following figures present the results of the evaluation conducted using the AHP model for the criteria and sub-criteria outlined in the study. Initially, the evaluation criteria and sub-criteria were identified based on Table 2. Subsequently, the collective input from expert personnel was used to define the AHP model results for the levels of criteria and sub-criteria. These levels were prepared for each criterion and sub-criterion based on Fig. 4. The AHP models prepared using ExpertChoice 11 provides a clear overview of statistical coefficients, variation rates, and the total number of evaluated matrices at each stage. A critical factor in preparing these matrices is ensuring the compliance of hourly consistency thresholds. If the matrices meet these consistency thresholds, it can be stated that the matrices are reliable and the results they provide are sufficiently valid. The final results represent the influence weights of the criteria and sub-criteria, along with their corresponding priorities. These weights and priorities are crucial for informed decision-making in the final stages of the analysis. Moreover, the hierarchical approach ensures that each factor is assessed rigorously, offering valuable insights for the study's conclusions.

According to the results of this study, it can be stated that there is a significant relationship between human resource satisfaction and the success of the construction projects of the company under study. The following hierarchical relationships can be extracted from the results of the AHP model:

$$A = 0.486\,G1 + 0.176\,G2 + 0.14\,G3 + 0.101\,G4 + 0.046\,G5 + 0.024\,G6 + 0.028\,G7 \quad (1)$$

$$G1 = 0.0503M1 + 0.252M2 + 0.141M3 + 0.07M4 + 0.035M5 \quad (2)$$

$$G2 = 0.649\,M6 + 0.279\,M7 + 0.072\,M8 \quad (3)$$

$$G3 = 0.555\,M9 + 0.293\,M10 + 0.115\,M11 + 0.038\,M12 \quad (4)$$

$$G4 = 0.571M13 + 0.244M14 + 0.102M15 + 0.054M16 \quad (5)$$

$$G5 = 0.448\,M17 + 0.364\,M18 + 0.104\,M19 + 0.065\,M20 + 0.036\,M21 \quad (6)$$

$$G6 = 0.649\,M22 + 0.279\,M23 + 0.072\,M24 \quad (7)$$

$$G7 = 0.653M25 + 0.179M26 + 0.098M27 + 0.051M28 \quad (8)$$

where, A represents the objective function or the significant correlation and impact coefficient between employee satisfaction and the success of construction projects. Criteria G1 through G7 denote the evaluation metrics, while M1 through M28 represent the sub-criteria. The decision-driven approach for utilizing these relationships operates such that the proposed model, owing to its consistency, can be applied to various projects. Specifically, in projects implemented by the Mashhad Regional Electricity Company, the model allows for quick field evaluations of the active personnel. The resulting values can then be input into the established relationships. Consequently, the estimated outcome serves as an indicator of employee satisfaction and its role in project success.

Based on the AHP model developed in this study, it can be concluded that the model is capable of being implemented across a wide range of ongoing and future projects within the company. Furthermore, expert opinions indicate that execution ability is the most critical criterion, ranking first with a priority weight of 48.6% in the company's projects. The second-ranking criterion is psychological commitment, highlighting the importance of addressing the mental and emotional well-being of employees in addition to ensuring project execution capabilities. This criterion achieved a weight of 17.6%, underscoring its significance. The findings also reveal that productivity improvement factors, with a weight of 2.4%, hold the lowest priority in influencing employee satisfaction. This suggests that while productivity factors are essential, their impact on overall satisfaction is relatively minimal compared to other criteria. The study emphasizes the need to balance operational efficiency with attention to the psychological needs of personnel for comprehensive project success.

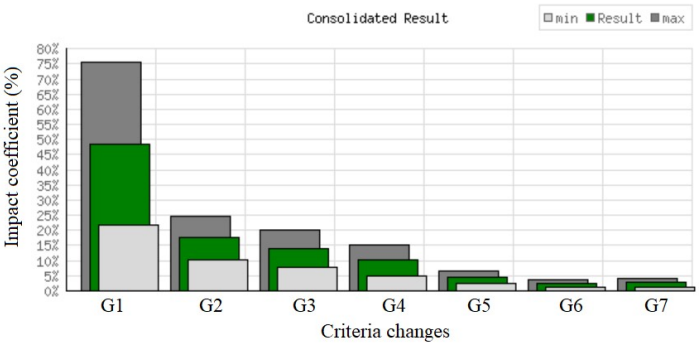

Fig. 4 AHP diagram of criteria evaluation

V. Conclusion

In conclusion, the findings of this study highlight the critical interplay between employee satisfaction and the success of construction projects, as demonstrated through the application of the AHP model. Among the seven evaluation criteria, execution ability emerged as the most influential factor, holding the highest priority with a weight of 48.6%. This underscores the importance of ensuring that employees possess the necessary skills, resources, and operational autonomy to effectively contribute to project execution. Additionally, the psychological commitment criterion, with a priority weight of 17.6%, reveals the significance of addressing employees' emotional well-being and motivation, which are pivotal in fostering a productive and committed workforce. Furthermore, while productivity improvement factors were identified as the least impactful criterion at 2.4%, their integration into the evaluation framework ensures a comprehensive approach to decision-making. The model's adaptability to various project scales and conditions, as evidenced by its application in a real-world case study for the Mashhad Regional Electricity Company, highlights its practical utility and reliability. This study emphasizes the need for a balanced focus on operational efficiency and employee-centric strategies to achieve sustained project success and workforce satisfaction.

Acknowledgment

We would like to express our sincere gratitude to the editorial team for their valuable feedback and guidance throughout the review process. Additionally, we extend our thanks to the reviewers for their meticulous attention to detail and constructive suggestions that greatly improved the quality of this manuscript. Your contributions have been instrumental in shaping this work.

Authors' contributions

Ehsan Mokhtari and Shahram Pourakaber conducted the main data analysis, contributed to the data collection, preprocessing, and interpretation, and were

responsible for drafting the initial manuscript. Sanaz Farshad assisted in the development of the methodology and performed validation checks, provided supervision, conceptual guidance, and critical revision of the manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors have not disclosed any competing interests.

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