

RESEARCH ARTICLE



Identification and Evaluation of Sustainable Factors in Urban Construction Project Management Using SWOT Technique

Nima Amani^{1,*} and Mahsima Naeij¹

¹Department of Civil Engineering, Islamic Azad University, Iran

Abstract: This study aims to create a management framework for identifying and evaluating sustainable factors in construction project management through strengths, weaknesses, opportunities, and threats analysis, focusing on the Rasht urban. The research method in this study includes the four steps. Step 1: Identifying internal and external sustainable factors using the Delphi technique; Step 2: Designing an analytic hierarchy process and calculating the weights of internal and external factors using SPSS 26 software; Step 3: Creating the internal factor and external factor evaluation and determining the final weights; Step 4: Model design and the analysis of strengths, weaknesses, opportunities, and threats. Quantitative strategic planning matrix analysis has been used to prioritize and identify the attractiveness of each of the designed strategies. By forming a quantitative strategic planning matrix, the existing twelve strategies have been prioritized. Based on the quantitative strategic planning matrix analysis, the priority of strategy selection includes the following: (1) The scenario of the construction of resistant infrastructure and creating the necessary regulations to strengthen and support construction projects with a score of 1.94 was ranked first; (2) the scenario of applying creativity and human resources experience to increase the productivity of construction projects with a score of 1.90 was ranked second; (3) the scenario of human resource training in order to enhance the expertise in the construction management complex with a score of 1.89 was ranked third. In this study, sustainable factors have been evaluated very accurately through quantitative strategic planning matrix, which has not been done more research so far. The study recommends implementing strength-opportunities strategies to improve construction projects in the Rasht urban area.

Keywords: strategic planning, sustainable development, SWOT analysis, urban construction project management

Abbreviations

<i>AHP</i>	Analytic Hierarchy Process
<i>EFE</i>	External Factor Evaluation
<i>IFE</i>	Internal Factor Evaluation
<i>NGOs</i>	Non-governmental organizations
<i>O</i>	Opportunities
<i>QSPM</i>	Quantitative Strategic Planning Matrix
<i>S</i>	Strengthen
<i>SO</i>	Strengthen – opportunities
<i>SWOT</i>	strengths, weaknesses, opportunities, and threats
<i>T</i>	Threats
<i>W</i>	Weakness

1. Introduction

Sustainable development as a comprehensive approach to overcoming environmental and resource problems has been

*Corresponding author: Nima Amanil, Department of Civil Engineering, Islamic Azad University, Iran. Email: nimaamani@iauc.ac.ir

prioritized in developing countries [1–7, 7–19]. Sustainability is increasingly considered a necessary tool for understanding social, economic, and environmental outcomes related to projects and project management. However, the lack of a structure for sustainability analysis in projects and the absence of specific tools mean the lack of a framework that can be useful and applicable to the project. The results of the research show that the major problems are in the projects and their construction management. Sustainable development and its indicators are not considered a management model. The results of applying sustainable development in projects include facilitating future access to capital in project management. The main goal of developing and implementing urban development projects is primarily to improve the quality and level of life of citizens and secondly to preserve and pay special attention to environmental issues (one of the important goals of sustainable urban development). The effort for development should be in a way that includes the interests of the majority of people. By using strategic planning models, it covers a wide range of managerial, social, economic, environmental, and physical issues of cities, and finally, this strategy is transformed into executive plans. Therefore, the analysis of urban strategy factors will help the city to know its strengths and opportunities

and strengthen them and to know its threats and weaknesses and avoid them or reduce them to the lowest possible level. Sustainable development is the concept of social and economic development along with the observance of environmental considerations and is a common solution of the international community to deal with the existing challenges such as the increasing destruction of the environment and the occurrence of numerous social damages as a result of economic development, and it is also a means to achieve prosperity and happiness at the national, regional and international levels. Sustainable development requires providing the basic needs of everyone and creating opportunities for them to fulfill their desires for a better life. Sustainable development is inherently a process based on changes in which the use of resources, the direction of investments, the direction of development, technology, and institutional changes are all coordinated with each other and improves the ability of current and future generations to meet human needs. The meaning of sustainable development is not only the protection of the environment, but a new concept of economic and social development, a development that considers justice and life facilities for all the people of the world. Strengths, weaknesses, opportunities, and threats (SWOT) analysis is one of the solutions of strategic planning that is used to evaluate the status of a plan or strategy and as its name suggests, it focuses on SWOT. Strengths describe which aspects of an issue or which part of an organization excels and what separates it from competitors. Weaknesses stop the effectiveness of a strategy at its desired level. Opportunities refer to favorable external factors that can give a competitive advantage to the target strategy. Threats refer to factors that have the possibility of harming the organization or its strategies. It should be remembered that this method is also used in general situation analysis in addition to strategic planning. In fact, this analysis should be considered an efficient tool to identify the environmental conditions and the internal ability of a system. The objective of this study is management framework of identification and evaluation of sustainable factors in urban

construction project management using the SWOT analysis in Rasht-Iran. The research method process in this study includes the four steps. Step 1: Identifying internal and external factors using the Delphi technique; Step 2: Designing an analytic hierarchy process (AHP) and calculating the weights of internal and external factors using Statistical Package for Social Sciences (SPSS) software; Step 3: Creating the internal factor evaluation (IFE) and external factor evaluation (EFE) and determining the final weights; Step 4: Model design and the analysis of SWOT. Quantitative strategic planning matrix (QSPM) analysis has been used to prioritize and identify the attractiveness of each of the designed strategies. The current study has been carried out in Rasht-Iran in 2022.

2. Materials and Methods

At first, in order to identify and classify internal and external factors, the Delphi questionnaire and mean test were used. Also, the AHP method has been used to determine the priority of research criteria and sub-criteria using SPSS software. The sustainable factors were collected based on the four dimensions of SWOT including strength, weakness, opportunity, and threat. In the following, the IFE and EFE Matrices are designed. Finally, by determining the final weights of the factors to design a quantitative matrix, the strategic planning phases of the SWOT analysis have been completed. Therefore, in this analysis, the following four steps have been taken (Figure 1).

2.1. Identification of internal and external sustainable factors

At first, the factors studied in the present study in order to identify and evaluate sustainable factors in construction project management were recognized by reviewing the research literature and similar studies and library sources. Based on the research literature and previous studies, a total of 37 factors were identified, which are mentioned in Table 1.

Figure 1
Flowchart of research method process

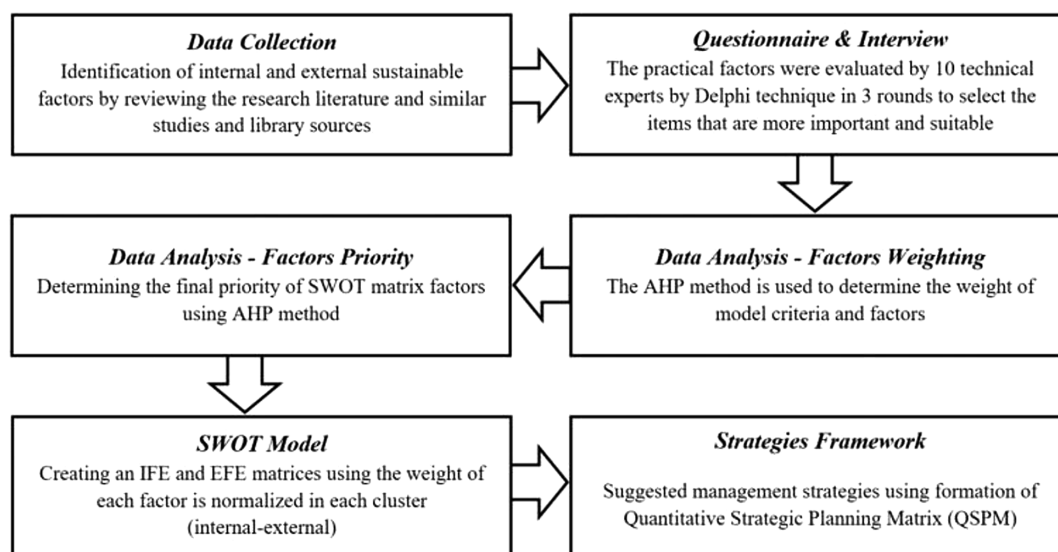


Table 1
Sustainability factors based on strength, weakness, opportunity, threats

Criteria	Sub-criteria	Sources
Strengths	The presence of committed and expert human resources in the project management group	Sepasi-Zangabadi et al. [20]
	The ability to transform new and sustainable ideas for the development of economic activities	Shams et al. [21], Zhao et al. [22], Zhao et al. [23]
	Allocation of dedicated budgets to construction projects in times of crisis	Sisto et al. [24]
	Transparency in terms and conditions of construction projects	Manouchehri-Miandoab et al. [25]
	Efforts to create effective collaborative project management in times of crisis	Zalqi [26]
	Using the capacity of the local young and educated workforce	Du et al. [27]
	Delay in the timely implementation of construction project plans	Saberi [28]
	Increase in energy consumption during the construction period due to more processes	Heravi and Laika [29], Amani [30], Aghazadeh and Yildirim [31]
	Non-observance of safety points and use of low-quality and low-durability materials	Salehipour [32], Bajjou and Chafi [33]
	General weakness in terms of management, expansion, and optimization of infrastructure in the region	Monjezi [34], Stanitsas et al. [35]
Weaknesses	Lack of suitable people in project management	Ghorbanzad-Kohnehsari et al. [36]
	Lack of specific infrastructure facilities in project management	Sadegh et al. [37]
	The existence of worn-out fabric in the city center and the need to make setbacks in many urban passages	Shamaei et al. [38]
	Low control and supervision of urban project activities	Gholipour and Sayyadi [39], Arthur and Mensah [40]
	Unilateral decision-making without the use of project people's opinions	Osuzugbo and Adenuga [41]
	The existence of a person-centered and partial attitude in contrast to a program-oriented attitude	Xu et al. [42]
	Weakness of the facility structure and appropriate equipment	Bazrafshan and Samani [43]
	Promoting strong, comprehensive, and sustainable economic growth and creating jobs for everyone	Wang et al. [10], Olawumi and Chan [44]
	A suitable context for the investment of all people in the project	Fallahtabar [45], Bathrinath et al. [46]
	Existence of potentials and potential geographical infrastructures for development and convergence in the regional space	Nosrati et al. [47], Essa and Fortune [48]
Opportunities	Existence of a suitable slope for the construction of sewage system and surface water collection in urban roads	Bahramnia and Malek-Hosseini [49], Zalqi [26]
	Attracting upstream resources to complete unfinished projects in urban construction plans	Feizollahi et al. [50]
	Increasing the employment rate and creating continuous jobs, which reduces social damage	Moharramzadeh et al. [51], Musonda and Gambo [52]
	Existence of laws and regulations to support construction projects	Mohammadzadeh et al. [53]
	Increasing people's awareness and their increasing demand to participate in managing the living environment	Hosseinzadeh et al. [54], Amani and Rezasoroush [55], Dalirazar and Sabzi [56]
	Playing a collaborative role with NGOs in city management and planning	Hosseinzadeh et al. [57]
	Existence of expert and experienced personnel in construction project management	Gazabizadeh et al. [58]
	The potential of creating popular participation due to the young population	Hosseinzadeh et al. [59]
	Government support and participation in construction projects	Taghilo et al. [60]
	Occurrence of social conflict caused by the difference in opinions of project managers	Khorasni-Anari et al. [61]
Threats	Lack of skilled human resources in the construction industry and project management	Afshari [62]
	High costs of repair and maintenance of construction equipment	Oke et al. [63]
	Lack of integrated and coordinated management in the project	Nti et al. [64], Warnock [65]
	The fragility of the environment in terms of the limitation of population settlement and economic activities	Sahani [66]
	The intervention of various organizations and legal abuses	Sarkheili et al. [67]
	Sudden changes in the laws of economic standards and imposing unnecessary costs in the project	Gari and Konstantopoulos [68], Zhong et al. [69]
	Lack of sufficient financial ability in the implementation of construction projects	Poriamehr [70]

2.2. Data screening for analysis of internal and external factors with the Delphi technique

The identified factors were checked using experts' opinions. The practical factors were evaluated by 10 technical experts who were serving the Research Center of Environment and Sustainable Development of Iran as manager of data and information analysis, manager of environmental engineering research group, manager of the center for education and communication with industry in the construction industry. These experts have had more than 20 years experience in the field. The assigned scores are between 1 and 5, and factors with scores below 4 were removed. The Delphi technique was continued in 3 rounds to select the items that are more important and suitable (Table A1). The sustainability factors were identified based on the response to the questions and the interview. A combination of group and individual interviews were undertaken with qualitative methods of analysis to develop an integrated process model. The results of the first round of these surveys through

questionnaire and interview showed that out of 37 factors, 14 factors did not receive the required assessment from the experts' point of view and were removed in the first phase. So, with the primary screening and removing duplicates, the second questionnaire consisting of 23 factors was prepared and presented. In the second round, 23 factors scored above 4. Next, in order to coordinate and agree on the opinions of the experts, the remaining factors were again transferred to the third round and surveyed. Since all the mean scores are higher than 4 at this phase, as a result, these 23 factors were selected as the final factors. Therefore, the Delphi technique was stopped and the identified factors were used for the final analysis.

3. Results and Discussion

The results of the final round of the Delphi technique are given in Table 2.

The AHP method has been used to determine the weight of model criteria and factors (Equations (1)–(3)).

Table 2
The results of the final round of the Delphi technique

Criteria	Sub-criteria	Experts										Mean
		1	2	3	4	5	6	7	8	9	10	
Strengths	The presence of committed and expert human resources in the project management group	5	5	4	5	4	4	4	5	4	3	4.3
	Allocation of dedicated budgets to construction projects in times of crisis	4	5	4	5	3	4	5	4	3	4	4.1
	Transparency in terms and conditions of construction projects	4	5	5	5	5	4	5	4	5	4	4.6
	Efforts to create effective collaborative project management in times of crisis	5	3	5	5	5	4	3	5	5	5	4.5
	Using the capacity of the local young and educated workforce	5	4	4	5	4	5	4	5	4	5	4.5
Weaknesses	Increase in energy consumption during the construction period due to more processes	4	5	5	4	3	5	5	5	5	4	4/5
	Non-observance of safety points and use of low-quality and low-durability materials	5	4	4	4	4	4	4	5	3	5	4.2
	General weakness in terms of management, expansion, and optimization of infrastructure in the region	5	5	5	4	5	5	5	5	5	4	4.8
	Lack of specific infrastructure facilities in project management	4	4	5	4	5	5	4	4	5	4	4.4
	The existence of worn-out fabric in the city center and the need to make setbacks in many urban passages	4	4	3	5	4	5	4	5	5	5	4.4
	The existence of a person-centered and partial attitude in contrast to a program-oriented attitude	5	3	5	5	5	4	5	4	4	5	4.5
Opportunities	Existence of potentials and potential geographical infrastructures for development and convergence in the regional space	5	4	5	4	4	5	5	4	3	4	4.3
	Attracting upstream resources to complete unfinished projects in urban construction plans	5	4	5	3	5	4	4	4	5	4	4.3
	Existence of laws and regulations to support construction projects	3	5	3	4	5	5	5	5	5	4	4.4
	Playing a collaborative role with NGOs in city management and planning	4	5	5	4	5	5	5	4	5	5	4.7
	Existence of expert and experienced personnel in construction project management	4	4	5	4	5	4	4	4	5	5	4.4
	The potential of creating popular participation due to the young population	5	5	4	4	5	3	5	4	4	5	4.4
Threats	Government support and participation in construction projects	5	5	5	4	5	5	4	5	4	4	4.6
	High costs of repair and maintenance of construction equipment	3	4	4	5	4	3	4	5	5	4	4.1
	Lack of integrated and coordinated management in the project	4	5	5	5	4	5	4	5	5	5	4.7
	The fragility of the environment in terms of the limitation of population settlement and economic activities	3	4	5	4	5	4	5	4	4	4	4.2
	The intervention of various organizations and legal abuses	4	5	4	4	4	5	5	5	4	5	4.5
Lack of sufficient financial ability in the implementation of construction projects	4	5	4	5	4	4	5	5	4	4	4.4	

$$CI = \frac{\lambda_{\max} - n}{n - 1} \tag{1}$$

CI: Consistency Index
n: The number of options in the problem
 $\lambda_{\max} = L$: Geometric mean approximation method

$$L = \frac{1}{n} \left[\sum_{i=1}^n (AW_i) / W_i \right] \tag{2}$$

AW_i: The product of the matrix of pairwise comparison of criteria × the eigenvector
W_i: Special vector or priority vector of criteria

Calculate the random index (Table 3):

$$CR = CI / RI \tag{3}$$

CR: Consistency Ratios
CI: Consistency Index
RI: Random Index

This test is based on compatibility ratios (C.R) of the comparison matrix. C.R of a comparison matrix pair is equal to the ratio of its compatibility degree to the corresponding random value. The

AHP pattern of criteria and sub-criteria of the model is presented in Table 4.

At this phase, the final priority of SWOT matrix indices factors is calculated. The results of the comparison of research sub-criteria and their respective weights form the SWOT matrix. To determine the final priority of SWOT matrix factors using the AHP method, the weight of the factors based on each criterion should be multiplied by the weight of the main criteria. By having the weight of each of the main criteria and sub-criteria, the weight of each of the factors is calculated. The results of the calculation and the weights related to SWOT matrix factors are shown in Table 5 and Figure 2.

3.1. Creating an IFE and EFE matrices

To prepare the IFE matrix, the strengths and weaknesses are listed, and the weight coefficient of each factor is inserted using the AHP method (Table 6). It is necessary to explain that the weight of each factor is normalized in each cluster (internal-external). Also, the score of the current status of each factor from the point of view of the strategic management team is inserted. To determine the final score of each factor, the coefficient of each factor is multiplied by its score, and the sum of the final scores of each factor is calculated to determine the final score. The same is done to prepare the EFE matrix (Table 7).

Table 3
Random index

N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0	0	52/0	88/0	10/1	24/1	34/1	4/1	44/1	48/1	51/1	53/1	55/1	57/1	58/1

Table 4
Criteria and sub-criteria of the research

Criteria	Sub-criteria	Symbol
Strengths	The presence of committed and expert human resources in the project management group	S1
	Allocation of dedicated budgets to construction projects in times of crisis	S2
	Transparency in terms and conditions of construction projects	S3
	Efforts to create effective collaborative project management in times of crisis	S4
	Using the capacity of the local young and educated workforce	S5
Weaknesses	Increase in energy consumption during the construction period due to more processes	W1
	Non-observance of safety points and use of low-quality and low-durability materials	W2
	General weakness in terms of management, expansion, and optimization of infrastructure in the region	W3
	Lack of specific infrastructure facilities in project management	W4
	The existence of worn-out fabric in the city center and the need to make setbacks in many urban passages	W5
	The existence of a person-centered and partial attitude in contrast to a program-oriented attitude	W6
Opportunities	Existence of potentials and potential geographical infrastructures for development and convergence in the regional space	O1
	Attracting upstream resources to complete unfinished projects in urban construction plans	O2
	Existence of laws and regulations to support construction projects	O3
	Playing a collaborative role with NGOs in city management and planning	O4
	Existence of expert and experienced personnel in construction project management	O5
	The potential of creating popular participation due to the young population	O6
	Government support and participation in construction projects	O7
Threats	High costs of repair and maintenance of construction equipment	T1
	Lack of integrated and coordinated management in the project	T2
	The fragility of the environment in terms of the limitation of population settlement and economic activities	T3
	The intervention of various organizations and legal abuses	T4
	Lack of sufficient financial ability in the implementation of construction projects	T5

Table 5
Determining the final priority of SWOT matrix factors using AHP method

Criteria	Criteria weight	Sub-criteria	Symbol	Sub-criteria weight	Final weight	Ranking
Strengths	303.0	The presence of committed and expert human resources in the project management group	S1	0.139	042.0	9
		Allocation of dedicated budgets to construction projects in times of crisis	S2	087.0	026.0	17
		Transparency in terms and conditions of construction projects	S3	263.0	080.0	4
		Efforts to create effective collaborative project management in times of crisis	S4	211.0	064.0	7
Weaknesses	169.0	Using the capacity of the local young and educated workforce	S5	301.0	091.0	2
		Increase in energy consumption during the construction period due to more processes	W1	069.0	012.0	22
		Non-observance of safety points and use of low-quality and low-durability materials	W2	286.0	048.0	8
		General weakness in terms of management, expansion, and optimization of infrastructure in the region	W3	219.0	037.0	11
		Lack of specific infrastructure facilities in project management	W4	161.0	027.0	15
		The existence of worn-out fabric in the city center and the need to make setbacks in many urban passages	W5	112.0	019.0	19
Opportunities	426.0	The existence of a person-centered and partial attitude in contrast to a program-oriented attitude	W6	153.0	026.0	18
		Existence of potentials and potential geographical infrastructures for development and convergence in the regional space	O1	234.0	100.0	1
		Attracting upstream resources to complete unfinished projects in urban construction plans	O2	068.0	029.0	13
		Existence of laws and regulations to support construction projects	O3	187.0	080.0	5
		Playing a collaborative role with NGOs in city management and planning	O4	201.0	086.0	3
		Existence of expert and experienced personnel in construction project management	O5	156.0	066.0	6
		The potential of creating popular participation due to the young population	O6	066.0	028.0	14
Threats	102.0	Government support and participation in construction projects	O7	088.0	038.0	10
		High costs of repair and maintenance of construction equipment	T1	111.0	011.0	23
		Lack of integrated and coordinated management in the project	T2	178.0	018.0	20
		The fragility of the environment in terms of the limitation of population settlement and economic activities	T3	159.0	016.0	21
		The intervention of various organizations and legal abuses	T4	288.0	030.0	12
Lack of sufficient financial ability in the implementation of construction projects	T5	263.0	027.0	16		

Figure 2
Determining the final priority of SWOT matrix factors using the AHP method

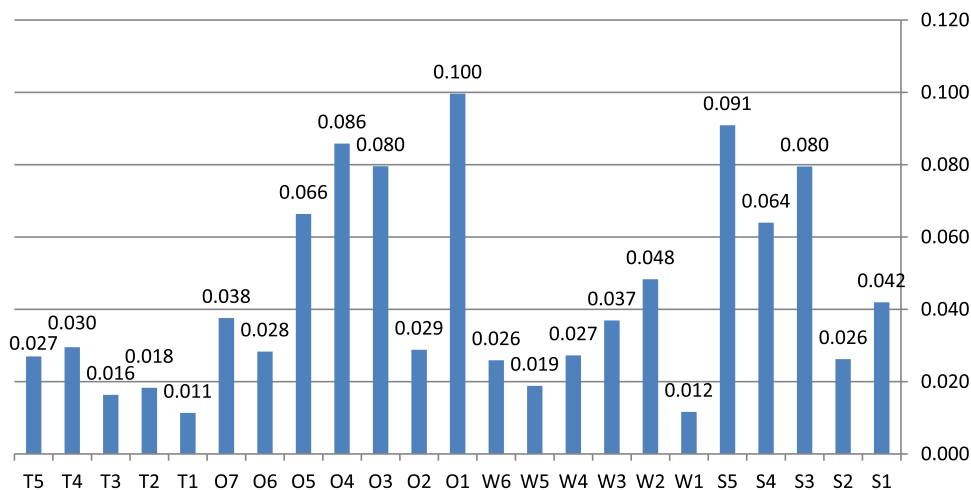


Table 6
IFE matrix

Internal factors	Sub-criteria	Weight	Status score	Weighted score
Strengths	S1	089.0	4	356.0
	S2	056.0	3	167.0
	S3	169.0	4	675.0
	S4	136.0	4	543.0
	S5	193.0	3	579.0
Weaknesses	W1	025.0	2	049.0
	W2	102.0	3	307.0
	W3	078.0	2	157.0
	W4	058.0	1	058.0
	W5	040.0	2	080.0
	W6	055.0	1	055.0
Total		1		025.3

Table 7
EFE matrix

External factors	Sub-criteria	Weight	Status Score	Weighted score
Opportunities	O1	189.0	3	566.0
	O2	054.0	2	109.0
	O3	151.0	4	602.0
	O4	162.0	4	650.0
	O5	126.0	3	377.0
	O6	054.0	2	107.0
	O7	071.0	2	142.0
Threats	T1	021.0	1	021.0
	T2	035.0	2	069.0
	T3	031.0	2	062.0
	T4	056.0	3	168.0
	T5	051.0	2	102.0
Total		1		974.2

The number of 3.025 obtained from the IFE matrix indicates the dominance of the strengths over the weaknesses of the organization.

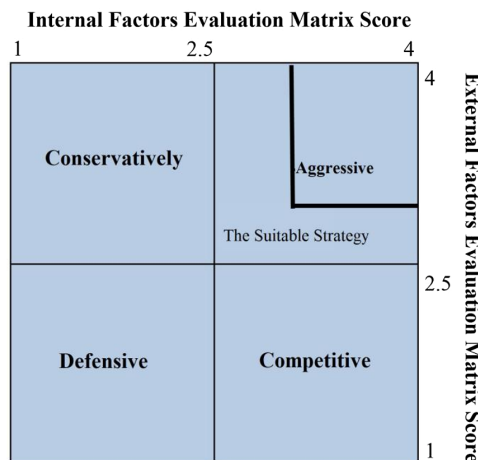
The score of 2.974 obtained from the EFE matrix indicates the dominance of opportunities over environmental threats. To determine the situation, the scores obtained from the IFE and EFE matrices should be placed in its vertical and horizontal dimensions and appropriate strategies can be specified for it. This matrix, which corresponds to the SWOT matrix and identifies appropriate strategies for construction project management, is presented in Figure 3.

The results obtained from the IFE and EFE matrices indicate that the situation of construction project management is in an aggressive state and this situation is caused by the dominance of internal strengths over internal weaknesses and opportunities over environmental threats of the bank. Therefore, by implementing strength-opportunities (SO) strategies, it is possible to make maximum use of external opportunities by using internal strengths.

3.2. Formation of QSPM

According to the IFE and EFE matrices, the strategies that should be considered are the strategies of using strengths to reach opportunities (SO). In addition, QSPM analysis has also been used to identify the attractiveness of each of the proposed

Figure 3
IFE and EFE matrices analysis



strategies in this field. Existing strategies have been prioritized by forming a QSPM. A summary of the scores for each strategy is provided. Therefore, in order to implement this, 12 strategies have been presented, which are mentioned in Table 8.

QSPM analysis has been used to prioritize and identify the attractiveness of each of the designed strategies. By forming a QSPM, the existing twelve strategies have been prioritized. Based on the QSPM analysis mentioned in Table 8, the priority of strategy selection is given in Table 9.

According to Table 8:

- 1) The scenario of the construction of resistant infrastructure and creating the necessary regulations to strengthen and support construction projects with a score of 1.94 was ranked first.
- 2) The scenario of applying creativity and human resources experience to increase the productivity of construction projects with a score of 1.90 was ranked second.
- 3) The scenario of human resource training in order to enhance the expertise in the construction management complex with a score of 1.89 was ranked third.

4. Importance and Limitation of Study

Looking at previous studies can be found that there are not any comprehensive researches to study the identification and evaluation of sustainable strategies in the urban construction project management. Many studies were conducted to develop the identification of sustainable factors through a small statistical population. There has been no comprehensive and detailed strategic planning for the strategic development of sustainable factors for the management of urban construction projects. In this study, sustainable factors have been evaluated very accurately through QSPM, which has not been done more research so far. The studies [20, 21, 25, 26, 29, 32, 34, 36, 38, 39, 43, 45, 47, 49–51, 53, 54, 57–62], focused on defensive or offensive strategies with SWOT technique, and basic factors and sub-factors were not specifically evaluated. In the present research, the factors and sub-factors of the study were collected from a variety of infrastructure projects in the areas of urban, agriculture, mining, construction, and road construction, while other research, focused only on one specialized field. In this study, factors and sub-factors were screened from three aspect of economical, social, and

Table 8
Suggested management strategies

Strategies	Symbol
Creating an engineering staff and their presence in the entire project and creating a construction management activities follow-up office	SO1
Strengthening and updating equipment and parts using educated workforce	SO2
The allocation of more government funds and investment in the private and civil sectors	SO3
Use of banking facilities to complete unfinished projects	SO4
Use of indigenous and young forces in order to reduce costs	SO5
Human resource training in order to enhance the expertise in the construction management complex	SO6
Applying creativity and human resources experience to increase the productivity of construction projects	SO7
Construction of resistant infrastructure and creating the necessary regulations to strengthen and support construction projects	SO8
Having transparency and setting tasks for how to implement the role of construction management and use of equipment	SO9
Determining method or methods to facilitate systems maintenance	SO10
Improving the quality of equipment and devices using appropriate geographical potential	SO11
The proper organizational structure and the precise definition of a person's responsibility description	SO12

Table 9
The priority of choosing management strategies

Strategy	SO1	SO2	SO3	SO4	SO5	SO6	SO7	SO8	SO9	SO10	SO11	SO12
Score	85.1	88.1	59.1	38.1	77.1	89.1	90.1	94.1	86.1	71.1	42.1	88.1
Rank	7	4	10	12	8	3	2	1	6	9	11	5

environmental. These factors were carefully evaluated and showed that factors related to human resources are the main challenges and opportunities for success in urban construction projects (Table 7). Strictness in obtaining permits to conduct interviews with experts and having a time limit to collect experts' opinions was one of the most important limitations that the current research has faced.

5. Conclusion

According to the purpose of this research, the current research is in the field of applied research. On the other hand, considering that library study methods and field methods such as questionnaires were used in this research, it can be stated that the current research is a descriptive research based on its nature and method. The results showed that the strategy of building resistant infrastructure and creating the necessary regulations to strengthen and support construction projects with a score of 1.94 is the first priority, the strategy of using creativity and human experience to increase the productivity of construction projects with a score of 1.90 In the second priority, and the scenario strategy of manpower training in order to increase expertise in the construction management complex is in the third priority with a score of 1.89. From the findings of the research, it can be concluded that the appropriate strategy in this research is a combination aggressive (SO) that includes the following:

- 1) Conducting management skills training courses for managers;
- 2) Government helps to invest in private and construction sectors;
- 3) Using bank facilities to complete unfinished projects;
- 4) Using local and young workers in order to reduce costs;
- 5) Manpower training in order to increase expertise in construction management;
- 6) Creating resilient infrastructure and creating the necessary regulations to strengthen and support construction projects;
- 7) Having transparency and defining the duties for how to implement the role of construction management.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

Data Availability Statement

Data are available from the corresponding author upon reasonable request.

Author Contribution Statement

Nima Amani: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Writing – review & editing, Visualization, Supervision, Project administration.
Mahsima Naeij: Software, Formal analysis, Resources, Data curation, Writing – original draft.

References

- [1] Chen, R. H., Lin, Y., & Tseng, M. L. (2015). Multicriteria analysis of sustainable development indicators in the construction minerals industry in China. *Resources Policy*, 46, 123–133. <https://doi.org/10.1016/j.resourpol.2014.10.012>
- [2] Salah, M., Elmasry, M., Mashhour, I. M., & Amer, N. (2023). A framework for assessing sustainability of construction projects. *Cleaner Engineering and Technology*, 13, 100626. <https://doi.org/10.1016/j.clet.2023.100626>
- [3] Nigjeh, M. J., & Amani, N. (2022). Evaluation of influential value engineering factors on the function of interchanges: Case studies in Iran. *Journal of Engineering and Applied Science*, 69(1), 48. <https://doi.org/10.1186/s44147-022-00100-9>
- [4] Shen, Y., Yue, S., Pu, Z., Lai, X., & Guo, M. (2020). Sustainable total-factor ecology efficiency of regions in China. *Science of the Total Environment*, 734, 139241. <https://doi.org/10.1016/j.scitotenv.2020.139241>

- [5] Bhaktikul, K., & Phonphoton, N. (2024). Development of an integrated sustainability indicator for the local people surrounding a reservoir project. *Sustainable Futures*, 7, 100223. <https://doi.org/10.1016/j.sfr.2024.100223>
- [6] Kuntiyawichai, K., & Aksorn, P. (2024). The knowledge and holistic management indicators to measure the sustainability of area-based infrastructure project (AIP). *Heliyon*, 10(9), e30159. <https://doi.org/10.1016/j.heliyon.2024.e30159>
- [7] Tuydes-Yaman, H., Dalkic-Melek, G., Chakarova, K., & Ozelik, A. S. (2024). Barriers and opportunities (B&O) for developing low carbon transportation (LCT) policies in Turkey. *Journal of Transport Geography*, 118, 103903. <https://doi.org/10.1016/j.jtrangeo.2024.103903>
- [8] Camana, D., Manzardo, A., Fedele, A., & Toniolo, S. (2021). Life cycle sustainability dashboard and communication strategies of scientific data for sustainable development. In J. Z. Ren (Ed.), *Methods in sustainability science: Assessment, prioritization, improvement, design and optimization* (pp. 135–152). Elsevier. <https://doi.org/10.1016/B978-0-12-823987-2.00006-4>
- [9] Tang, Y., Xia, N., Varga, L., Tan, Y., Hua, X., & Li, Q. (2022). Sustainable international competitiveness of regional construction industry: Spatiotemporal evolution and influential factor analysis in China. *Journal of Cleaner Production*, 337, 130592. <https://doi.org/10.1016/j.jclepro.2022.130592>
- [10] Wang, Y., Feng, Y., & Liu, L. (2024). An improved case-based reasoning approach for sustainable rural development applied to strategic responses. *Engineering Applications of Artificial Intelligence*, 133, 108316. <https://doi.org/10.1016/j.engappai.2024.108316>
- [11] Cui, P., Liu, Y., Ju, X., & Gu, T. (2022). Key influencing factors and optimization strategy of epidemic resilience in urban communities—A case study of Nanjing, China. *International Journal of Environmental Research and Public Health*, 19(16), 9993. <https://doi.org/10.3390/ijerph19169993>
- [12] Ngu, H. J., Lee, M. D., & Bin-Osman, M. S. (2020). Review on current challenges and future opportunities in Malaysia sustainable manufacturing: Remanufacturing industries. *Journal of Cleaner Production*, 273, 123071. <https://doi.org/10.1016/j.jclepro.2020.123071>
- [13] Yu, H., Wen, B., Zahidi, I., Fai, C. M., & Madsen, D. Ø. (2024). China's green building revolution: Path to sustainable urban futures. *Results in Engineering*, 23, 102430. <https://doi.org/10.1016/j.rineng.2024.102430>
- [14] Zhe, W., Li, Z., & Jing, S. (2011). On the beauty of green expo architecture and sustainable development-taking “China pavilion” as an example. *Procedia Engineering*, 21, 163–167. <https://doi.org/10.1016/j.proeng.2011.11.2000>
- [15] Kowalik, J., Zawada, M., & Kuceba, R. (2017). Regional diversification of the level of economic development in Poland. *PEOPLE: International Journal of Social Sciences*, 3(2), 730–745. <https://doi.org/10.20319/pijss.2017.32.730745>
- [16] Yang, Z., Yang, H., & Wang, H. (2020). Evaluating urban sustainability under different development pathways: A case study of the Beijing-Tianjin-Hebei region. *Sustainable Cities and Society*, 61, 102226. <https://doi.org/10.1016/j.scs.2020.102226>
- [17] Cobbinah, P. B., Poku-Boansi, M., & Peprah, C. (2017). Urban environmental problems in Ghana. *Environmental Development*, 23, 33–46. <https://doi.org/10.1016/j.envdev.2017.05.001>
- [18] Hergüner, B. (2021). Rethinking public administration education in the period of pandemic: Reflections of public administration students on online education through a SWOT analysis. *Thinking Skills and Creativity*, 41, 100863. <https://doi.org/10.1016/j.tsc.2021.100863>
- [19] Shakerian, H., Dehnavi, H. D., & Ghanad, S. B. (2016). The implementation of the hybrid model SWOT-TOPSIS by fuzzy approach to evaluate and rank the human resources and business strategies in organizations (Case study: Road and urban development organization in Yazd). *Procedia—Social and Behavioral Sciences*, 230, 307–316. <https://doi.org/10.1016/j.sbspro.2016.09.039>
- [20] Sepasi-Zangabadi, M., JanMohammadi, M., & Bagheri, M. (2021). Barresi vaziyat sistem estandardsazi bar asas tahlil savat (SWOT) moordmataleh: Yek sazman nezami [Assessing the status of the standardization system based on (SWOT) the case study: A digital-law enforcement organization]. *Logistics Thought Scientific Publication*, 20(76), 55–92.
- [21] Shams, M. R., Khan-Mohammadi, M. H., & Kordlooyi, H. R. (2018). Tarahy tarkybehy motodehyay SWOT ve QFD dar tadoyne esteratzhycepay ksab ve kar dar sharaytabahran egtesady (motaleh moordy: Sharkt sanaye basteh bandy ayran) [Combined design of SWOT and QFD methods in developing business strategies in economic situation (Case study: Iran Packaging Company)]. *Journal of Management Accounting and Auditing Knowledge*, 7(25), 239–250.
- [22] Zhao, L., Mbachu, J., & Liu, Z. (2020). Identifying significant cost-influencing factors for sustainable development in construction industry using structural equation modelling. *Mathematical Problems in Engineering*, 2020(1), 4810136. <https://doi.org/10.1155/2020/4810136>
- [23] Zhao, S., Zhang, P., & Li, W. (2021). A study on evaluation of influencing factors for sustainable development of smart construction enterprises: Case study from China. *Buildings*, 11(6), 221. <https://doi.org/10.3390/buildings11060221>
- [24] Sisto, R., García-López, J., Quintanilla, A., de Juanes, Á., Mendoza, D., Lumbreras, J., & Mataix, C. (2020). Quantitative analysis of the impact of public policies on the sustainable development goals through budget allocation and indicators. *Sustainability*, 12(24), 10583. <https://doi.org/10.3390/su122410583>
- [25] Manouchehri-Miandoab, A., Hekmatnya, H., & Mousavi, M. (2020). Forecasting of improving commission performance article 100 by providing an integrated model, Scenario-SWOT-QSPM (case study: Yazd city). *Geography and Urban Space Development*, 6(2), 89–108. <https://doi.org/10.22067/gusd.v6i2.80978>
- [26] Zalqi, M. (2021). Madirit ab epehei sathi (motaleh moordi: Sheerestan dezfol) ba estefadeh az madel SWOT [Surface water management (case study: Dezful city) using SWOT model]. *Geography and Human Relationships*, 4(2), 175–188. <https://doi.org/10.22034/gahr.2021.287869.1564>
- [27] Du, B., Ye, S., Gao, P., Ren, S., Liu, C., & Song, C. (2024). Analyzing spatial patterns and driving factors of cropland change in China's National Protected Areas for sustainable management. *Science of the Total Environment*, 912, 169102. <https://doi.org/10.1016/j.scitotenv.2023.169102>
- [28] Saberi, A. (2017). Barresi shakhs epehei esli dar yek estandardsazi motlub [Examining the main indicators in a desirable standardization]. *Journal of Science and Engineering Elites*, 2(2), 424–429.
- [29] Heravi, G., & Laika, M. (2017). Study and evaluation of prefabricated concrete buildings industry by SWOT analysis: Sustainable development approach. *Amirkabir Journal of Civil Engineering*, 49(3), 187–190. <https://doi.org/10.22060/CEEJ.2017.12553.5228>

- [30] Amani, N. (2020). Energy simulation and management of the main building component materials using comparative analysis in a mild climate zone. *Journal of Renewable Energy and Environment*, 7(3), 29–46. <https://doi.org/10.30501/jree.2020.227079.1101>
- [31] Aghazadeh, E., & Yildirim, H. (2021). Assessment the effective parameters influencing the sustainable materials selection in construction projects from the perspective of different stakeholders. *Materials Today: Proceedings*, 43, 2443–2454. <https://doi.org/10.1016/j.matpr.2021.02.280>
- [32] Salehipour, M. (2018). Tadvin ranpabard kasb ve kari bangaecpehei sanat (moord motaleh: Cpehtelalay zanjirehaye manpar): SWOT moteomanavazi ba roykard [Developing a business strategy for hospitality industry firms with a SWOT approach (case study: Mehr chain hotels)]. *Geographical Journal of Tourism Space*, 7(26), 87–104.
- [33] Bajjou, M. S., & Chafi, A. (2022). Exploring the critical waste factors affecting construction projects. *Engineering, Construction and Architectural Management*, 29(6), 2268–2299. <https://doi.org/10.1108/ECAM-12-2020-1097>
- [34] Monjezi, N. (2020). Arzyabi asarat bahran rizgardehya bar tolidat bakhshesaye mokhtelf keshavarzi dar estan khozestan ba estefadeh az rosh tahlil esterategic-salsaleh maratabi (SWOT-AHP) [Assessment of dust crisis effects on different sectors of agricultural production in Khuzestan province using strategic analysis—Analytical hierarchy process method (SWOT-AHP)]. *Journal of Natural Environmental Hazards*, 9(23), 117–134. <https://doi.org/10.22111/jneh.2019.29510.1509>
- [35] Stanitsas, M., Kirytopoulos, K., & Leopoulos, V. (2021). Integrating sustainability indicators into project management: The case of construction industry. *Journal of Cleaner Production*, 279, 123774. <https://doi.org/10.1016/j.jclepro.2020.123774>
- [36] Ghorbanzad-Kohnehsari, M., Hasanimehr, S. S., Shahmari, R., & Asghari, H. (2021). Investigating the level of rural development using SWOT and AHP models (case study: Pesikhan village, central part of Rasht). *Journal of Geography and Environmental Studies*, 10(38), 69–81.
- [37] Sadegh, J., Rojuee, M., & Ghasemi-Khozani, M. (2018). Tadvin ranpabardehaye ehyaie jadeh valitba cpehdaf toseh fareang ziyart bah rosh SWOT [Setting strategies for reviving the Velayat Road aimed at developing pilgrimage culture through SWOT model]. *Journal of Razavi Culture*, 6(22), 123–147.
- [38] Shamaei, A., Sasanpour, F., Soleimani, M., Ahadnejad, M., & Heidari, T. (2016). Tahlil zistpaziri baftenpehei farsodh shehari (motaleh moordi: Baft farsodh shehar zanjan) [The analysis of livability in urban distressed areas: Old textures of Zanjan (a case study)]. *Human Geography Research Quarterly*, 48(4), 783–799. <https://doi.org/10.22059/JHGR.2016.53481>
- [39] Gholipour, Y., & Sayyadi, M. A. (2019). Barnameh rizi ranpabardi ekotorism payedar dar sheharehaye kuchak ba estefadeh az madel cpehei tahlil ameli taedi, SWOT ve QSPM (motaleh ye moordi: sheerestan Masal, Guilan) [Strategic planning of sustainable ecotourism in small cities using confirmatory factor analysis, SWOT and QSPM models (case study: Masal, Guilan)]. *Urban Management Studies*, 11(37), 1–16.
- [40] Arthur, S. N. A., & Mensah, J. V. (2006). Urban management and heritage tourism for sustainable development: The case of Elmina cultural heritage and management programme in Ghana. *Management of Environmental Quality*, 17(3), 299–312. <https://doi.org/10.1108/14777830610658719>
- [41] Osuizugbo, I. C., & Adenuga, O. A. (2024). Decisive factors for decision-making to achieving sustainable procurement in construction projects. *International Journal of Building Pathology and Adaptation*, 42(6), 1185–1202. <https://doi.org/10.1108/IJBPA-04-2022-0065>
- [42] Xu, H., Zhong, T., Chen, Y., & Zhang, J. (2023). How to simulate future scenarios of urban stormwater management? A novel framework coupling climate change, urbanization, and green stormwater infrastructure development. *Science of the Total Environment*, 874, 162399. <https://doi.org/10.1016/j.scitotenv.2023.162399>
- [43] Bazrafshan, M., & Samani, S., (2019). Avamel mwrsar bar toseh gardashgari keshavarzi (moord motaleh: Sheerestan joharam) [Factors affecting the development of agricultural tourism (case study: Jahrom County)]. *Journal of Tourism Management Studies*, 14(47), 193–220. <https://doi.org/10.22054/tms.2019.10612>
- [44] Olawumi, T. O., & Chan, D. W. (2020). Key drivers for smart and sustainable practices in the built environment. *Engineering, Construction and Architectural Management*, 27(6), 1257–1281. <https://doi.org/10.1108/ECAM-06-2019-0305>
- [45] Fallahtabar, N. (2018). Chaleshesaye tarhnpehei toseh rostayi az didegah toseh payedar (ba estefadeh az madel swot) [Challenges of rural development initiatives from sustainable development perspective using SWOT model]. *Quarterly of Geography & Regional Planning*, 7(28), 187–202.
- [46] Bathrinath, S., Mohan, S., Koppiahraj, K., Bhalaji, R. K. A., & Santhi, B. (2022). Analysis of factors affecting sustainable performance in construction sites using fuzzy AHP-WASPAS methods. *Materials Today: Proceedings*, 62(6), 3118–3121. <https://doi.org/10.1016/j.matpr.2022.03.393>
- [47] Nosrati, S., Akhbari, M., & Sarvar, R. (2016). Tahlil movane cpehmgarayi iran ba keshorehaye piramoni dargharn bist ve yekam ve araetye yek barnamegye esterategic ba estefadeh az taknik SWOT ve MCDM [Analyzing the obstacles of Iran's convergence with neighboring countries in the 21st century and presenting a strategic plan using SWOT and MCDM techniques]. *Quarterly of Geography & Regional Planning*, 6(23), 77–92.
- [48] Essa, R., & Fortune, C. (2008). Pre-construction evaluation practices of sustainable housing projects in the UK. *Engineering, Construction and Architectural Management*, 15(6), 514–526. <https://doi.org/10.1108/09699980810916960>
- [49] Bahramnia, H., & Malek-Hosseini, A. (2018). Oloitbandi ranpabardehaye moord takid ve montekhab peyadeh madari shehar nehavand ba estefadeh az abzar QSPM tahlil ve tajziyeh dar SWOT [Prioritizing the emphasized and selected pedestrian-oriented strategies of Nahavand city using the QSPM tool in SWOT analysis]. *Journal of New Attitudes Human Geography*, 10(3), 61–73.
- [50] Feizollahi, S., Latifian, B., & Nowrouzi, H. (2020). Barresi ve entekhab esteratzhi bacpehineh baraye shehardari eyalam ba bacparecgiri az madel tarkybe ANP-SWOT [Investigating and selecting the optimal strategy for Ilam Municipality using the SWOT-ANP combined model]. *A Scientific Journal of Ilam Culture*, 20(64.65), 199–223.
- [51] Moharramazadeh, M., Ganji, H., Hosseini, M. E., & Ganji, M. (2020). Tadvin ranpabardehyay ijad ghatab gardashgari majerajuyaneh dar kuhostaneyay estan ordbil ba estefadeh az taknik SWOT [Developing strategies to create an adventure tourism hub in the mountains of Ardabil Province using SWOT technique]. *Sport Physiology & Management Investigations*, 12(3), 185–191.

- [52] Musonda, I., & Gambo, N. (2021). Mediation effect of partnership on procurement strategy factors influencing sustainable smart housing development, Nigeria. *Built Environment Project and Asset Management*, 11(3), 454–467. <https://doi.org/10.1108/BEPAM-12-2019-0139>
- [53] Mohammadzadeh, S. A., Saghafi, M., & Faghani, M. (2019). Barnameh rizi esterategic sharkat cpehei taavani barasas madel SWOT moord motaleh estan kharasan jenobi [Strategic planning of knowledge-based companies on the basis of SWOT model for South Khorasan Province of Iran]. *Journal of Modiriati-E-Farda*, 18(61), 181–192.
- [54] Hosseinzadeh, N., Estelaji, A., & Daniali, T. (2021). Tabiyn ranpabardehaye madirit bahran dar baft cpehei farsodeh shehari (motaleh moordi: Mantegheh19 shehardari taharan) [Explaining crisis management strategies in dilapidated urban contexts (case study: District 19 of Tehran Municipality)]. *Journal of New Attitudes Human Geography*, 13(1), 114–133.
- [55] Amani, N., & Rezasoroush, A. (2021). Building energy management using building information modeling: Evaluation of building components and construction materials. *Journal of Renewable Energy and Environment*, 8(2), 31–38. <https://doi.org/10.30501/jree.2020.236391.1120>
- [56] Dalirazar, S., & Sabzi, Z. (2022). Barriers to sustainable development: Critical social factors influencing the sustainable building development based on Swedish experts' perspectives. *Sustainable Development*, 30(6), 1963–1974. <https://doi.org/10.1002/sd.2362>
- [57] Hosseinzadeh, N., Nezafati-Namin, F., Tavakoli-Yaraki, A., Ahmadi, H., & Ghafari, Y. (2020). Tahlil sakhtar fazayikalbadi baft farsodeh shehari ba estefadeh az rosh tahlil esterategic-salsaleh maratabi(SWOT-AHP) [Analysis of spatial-physical structure of worn-out urban fabric, using strategic-hierarchical analysis (SWOT-AHP) method]. *Geography and Human Relationships*, 2(4), 352–375.
- [58] Gazabizadeh, M., Sabzghabaei, G. R., & Dashti, S. (2019). Tahlil ve arzyabi ranpabardehaye hafazati talab teorolazim ba estefadeh az matris cpehei SWOT ve QSPM [Analysis and evaluation of Hour-Al-Azim Wetland conservation strategies using SWOT and QSPM matrix]. *Irrigation Sciences and Engineering*, 41(4), 45–59. <https://doi.org/10.22055/jise.2017.18614.1345>
- [59] Hosseinzadeh, N., Ghafari, Y., Panahi, M., Emadi, P., & Bayat, G. (2020). Arzyabi hokmravayi khob shehari dar amolkard madirit shehar eslameshahr ba estefadeh az madel ranpabardi Swot [Assessment, good urban governance in the management performance of Eslamshahr, using the SWOT model]. *Geography and Human Relationships*, 2(4), 185–203.
- [60] Taghilo, A. A., Majnoony, A., & Aftab, A. (2020). Arzyaby ve oloytabandy movane mwrsar dar mosharkat ejtemay rostayeyan dar tarheyay omrany ba estefadeh az AHP-SWOT (motaleh moordy: Dahastan benajoy shmaly) [Assessment and prioritization of factors reducing social participation in development projects using AHP-SWOT (case study: North Banajoye rural district)]. *Geographical Engineering of Territory*, 3(6), 163–178.
- [61] Khorasni-Anari, A., Hasan-Zadeh-Nefooti, M., & Jamali, A. A. (2020). Marafi rayayafteoja ve esteratzhitacpehei menasb jalab mosharkat rostaiyan dar ejraye tarhtacpehei menabe tabiei bah rosh AHP ve madel ranpabardi SWOT (moordi shenasi: Rostaye khro alia ve sefli sheerestan tabs) [Introducing appropriate approaches and strategies to attract participation of villagers in implementing natural resource projects using AHP and SWOT (case study: Kharv Olya and Sofla villages in Tabas)]. *Geography and Territorial Spatial Arrangement*, 10(36), 21–36.
- [62] Afshari, M. (2020). Arzyabi petansilenpehei gardashgari keshavarzi barasas tahlil SWOT ve farayand tahlil shabkeyi (ANP), moord motaleh: Sheerestan semiram [Evaluation of agricultural tourism potentials based on SWOT analysis and analytical network process (ANP), case study: Semirom County]. *Tourism Research and Sustainable Development Journal*, 11(3), 43–54.
- [63] Oke, A. E., Aliu, J., Onajite, S., & Simeon, M. (2024). Success factors of digital technologies (DT) tools adoption for sustainable construction in a developing economy. *Construction Innovation*, 24(4), 950–964. <https://doi.org/10.1108/CI-08-2022-0207>
- [64] Nti, E. K., Kranjac-Berisavljevic, G., Doke, D. A., Wongnaa, C. A., Attafua, E. E., & Gyan, M. A. (2023). The impact of artisanal gold mining on the sustainability of Ghana's river basins: The case of the Pra Basin. *Environmental and Sustainability Indicators*, 19, 100264. <https://doi.org/10.1016/j.indic.2023.100264>
- [65] Warnock, A. C. (2007). An overview of integrating instruments to achieve sustainable construction and buildings. *Management of Environmental Quality: An International Journal*, 18(4), 427–441. <https://doi.org/10.1108/14777830710753820>
- [66] Sahani, N. (2021). Application of hybrid SWOT-AHP-FuzzyAHP model for formulation and prioritization of ecotourism strategies in Western Himalaya, India. *International Journal of Geoheritage and Parks*, 9(3), 349–362. <https://doi.org/10.1016/j.ijgeop.2021.08.001>
- [67] Sarkheili, E., Salari, M., & Safavi-Sohi, M. (2017). Naqsh bar tahlili takholfat sakhtamani dar nakami tarh cpehei toseh shehari kolalaneshehar taharan [Analyzing the role of constructional violations in the failure of urban development plans of the Tehran metropolis]. *Bagh-e Nazar*, 14(51), 5–20.
- [68] Garri, M., & Konstantopoulos, N. (2013). Market information acquisition: A prerequisite for successful strategic entrepreneurship. *Procedia: Social and Behavioral Sciences*, 73, 643–651. <https://doi.org/10.1016/j.sbspro.2013.02.101>
- [69] Zhong, Y., Chen, X., Yao, X., Wang, Z., & Chang, H. L. (2024). Natural resources and the trilemma of financial development, institutions, and markets: Sustainable development pathway via natural resources for China. *Resources Policy*, 90, 104759. <https://doi.org/10.1016/j.resourpol.2024.104759>
- [70] Poriamehr, R. (2021). Tahlil ve arzyabi baft farsodeh ve nakaramadi shehari bah manzur baz afarini shehari (motaleh moordi: Sheerestan khram abad) ba estefadeh az madel SWOT [Analysis and evaluation of worn texture and urban inefficiency for urban regeneration (case study: Khorramabad city) using SWOT model]. *Geography and Human Relationships*, 3(4), 570–584. <https://doi.org/10.22034/gahr.2021.286448.1559>

How to Cite: Amani, N., & Naeij, M. (2025). Identification and Evaluation of Sustainable Factors in Urban Construction Project Management Using SWOT Technique. *Green and Low-Carbon Economy*, 4(1), 48–59. <https://doi.org/10.47852/bonviewGLCE42021909>

Appendix

Table A1
Data screening for analysis of internal and external factors with the Delphi technique

Delphi Technique/First Round		Experts											
		1	2	3	4	5	6	7	8	9	10	Mean	
Strengths	The presence of committed and expert human resources in the project management group	5	5	4	4	5	4	4	5	4	5	4.5	
	The ability to transform new and sustainable ideas for the development of economic activities	3	4	4	3	2	3	4	4	3	4	3.4	
	Allocation of dedicated budgets to construction projects in times of crisis	4	5	4	5	3	5	5	4	3	4	4.2	
	Transparency in terms and conditions of construction projects	5	5	4	3	5	4	5	4	4	4	4.3	
	Efforts to create effective collaborative project management in times of crisis	5	3	5	4	4	4	3	4	5	5	4.2	
Weaknesses	Using the capacity of the local young and educated workforce	5	4	4	5	5	4	4	5	5	5	4.6	
	Delay in the timely implementation of construction project plans	3	2	2	4	3	2	1	3	4	5	2.9	
	Increase in energy consumption during the construction period due to more processes	4	5	4	5	3	5	4	4	5	4	4.3	
	Non-observance of safety points and use of low-quality and low-durability materials	5	5	4	3	4	5	3	5	2	5	4.1	
	General weakness in terms of management, expansion, and optimization of infrastructure in the region	5	3	5	4	5	4	5	5	4	4	4.4	
	Lack of suitable people in project management	4	3	4	4	3	5	3	2	3	5	3.6	
	Lack of specific infrastructure facilities in project management	4	5	5	4	3	5	4	5	5	5	4.5	
	The existence of worn-out fabric in the city center and the need to make setbacks in many urban passages	4	4	3	4	4	4	4	5	5	5	4.2	
	Low control and supervision of urban project activities	4	3	4	3	3	4	2	4	2	4	3.3	
	Unilateral decision-making without the use of project people's opinions	4	3	4	3	3	4	3	3	2	3	3.2	
	The existence of a person-centered and partial attitude in contrast to a program-oriented attitude	5	4	5	5	3	4	5	4	4	3	4.2	
	Opportunities	Weakness of the facility structure and appropriate equipment	4	4	4	3	4	4	3	5	2	5	3.8
		Promoting strong, comprehensive, and sustainable economic growth and creating jobs for everyone	4	3	2	4	1	2	5	3	3	4	3.1
A suitable context for the investment of all people in the project		5	2	5	2	2	4	3	3	3	4	3.3	
Existence of potentials and potential geographical infrastructures for development and convergence in the regional space		3	5	4	5	4	4	5	5	5	4	4.4	
Existence of a suitable slope for the construction of sewage system and surface water collection in urban roads		3	3	4	4	4	3	5	3	3	4	3.6	
Attracting upstream resources to complete unfinished projects in urban construction plans		4	5	4	3	5	4	4	5	3	4	4.1	
Increasing the employment rate and creating continuous jobs, which reduces social damage		3	2	3	4	4	3	4	3	2	3	3.1	
Existence of laws and regulations to support construction projects		4	5	3	3	5	5	4	5	5	4	4.3	
Increasing people's awareness and their increasing demand to participate in managing the living environment		3	2	3	4	4	3	4	2	4	3	3.2	
Playing a collaborative role with NGOs in city management and planning		5	5	4	4	5	5	3	4	3	5	4.3	
Existence of expert and experienced personnel in construction project management		3	4	4	4	5	4	4	5	5	5	4.3	
The potential of creating popular participation due to the young population		4	5	4	5	5	3	5	4	4	5	4.4	
Government support and participation in construction projects		5	3	5	4	5	4	2	5	4	5	4.2	
Threats	Occurrence of social conflict caused by the difference in opinions of project managers	3	2	4	2	3	3	2	3	2	4	2.8	
	Lack of skilled human resources in the construction industry and project management	2	3	4	4	4	3	2	4	4	4	3.4	
	High costs of repair and maintenance of construction equipment	4	3	5	4	5	4	5	3	4	4	4.1	
	Lack of integrated and coordinated management in the project	4	5	5	5	4	3	4	4	5	5	4.4	
	The fragility of the environment in terms of the limitation of population settlement and economic activities	3	4	3	4	5	4	5	5	4	4	4.1	
	The intervention of various organizations and legal abuses	4	5	4	5	4	5	4	5	4	5	4.5	
	Sudden changes in the laws of economic standards and imposing unnecessary costs in the project	1	3	3	3	2	4	3	2	3	4	2.8	
	Lack of sufficient financial ability in the implementation of construction projects	4	5	5	3	4	4	5	4	4	4	4.2	

Delphi Technique/Second Round												
Criteria	Sub-criteria	Experts										
		1	2	3	4	5	6	7	8	9	10	Mean
Strengths	The presence of committed and expert human resources in the project management group	5	4	4	5	4	4	4	5	4	3	4.2
	Allocation of dedicated budgets to construction projects in times of crisis	4	4	4	5	3	4	5	4	3	4	4
	Transparency in terms and conditions of construction projects	4	5	4	5	5	4	5	4	5	4	4.5
	Efforts to create effective collaborative project management in times of crisis	5	3	5	4	3	4	3	5	5	5	4.2
	Using the capacity of the local young and educated workforce	5	4	4	5	4	4	4	5	4	5	4.4
Weaknesses	Increase in energy consumption during the construction period due to more processes	4	5	5	4	3	5	5	3	5	4	4.3
	Non-observance of safety points and use of low-quality and low-durability materials	5	4	4	4	4	5	5	5	3	5	4.4
	General weakness in terms of management, expansion, and optimization of infrastructure in the region	5	5	5	4	5	4	5	5	5	4	4.7
	Lack of specific infrastructure facilities in project management	4	4	5	4	4	5	4	4	5	4	4.3
	The existence of worn-out fabric in the city center and the need to make setbacks in many urban passages	5	4	3	4	4	5	4	5	5	5	4.4
	The existence of a person-centered and partial attitude in contrast to a program-oriented attitude	5	5	5	5	5	4	5	4	4	5	4.7
	Existence of potentials and potential geographical infrastructures for development and convergence in the regional space	4	4	5	4	4	5	5	4	3	4	4.2
Opportunities	Attracting upstream resources to complete unfinished projects in urban construction plans	5	5	5	3	5	4	4	5	5	4	4.5
	Existence of laws and regulations to support construction projects	4	5	3	3	5	5	4	5	5	4	4.3
	Playing a collaborative role with NGOs in city management and planning	4	5	4	4	5	5	4	4	5	5	4.5
	Existence of expert and experienced personnel in construction project management	4	4	4	4	5	4	4	4	5	5	4.3
	The potential of creating popular participation due to the young population	5	5	4	5	5	5	5	4	4	5	4.7
	Government support and participation in construction projects	5	4	5	4	5	4	4	5	4	4	4.4
	High costs of repair and maintenance of construction equipment	3	4	4	5	5	3	4	5	5	4	4.2
Threats	Lack of integrated and coordinated management in the project	4	5	5	5	5	5	4	5	5	5	4.8
	The fragility of the environment in terms of the limitation of population settlement and economic activities	3	4	4	4	5	4	5	4	4	4	4.1
	The intervention of various organizations and legal abuses	4	5	4	4	4	5	5	5	4	5	4.5
	Lack of sufficient financial ability in the implementation of construction projects	4	5	5	5	5	4	5	5	4	4	4.6

Delphi Technique/Third Round												
Criteria	Sub-criteria	Experts										
		1	2	3	4	5	6	7	8	9	10	Mean
Strengths	The presence of committed and expert human resources in the project management group	5	5	4	5	4	4	4	5	4	3	4.3
	Allocation of dedicated budgets to construction projects in times of crisis	4	5	4	5	3	4	5	4	3	4	4.1
	Transparency in terms and conditions of construction projects	4	5	5	5	5	4	5	4	5	4	4.6
	Efforts to create effective collaborative project management in times of crisis	5	3	5	5	5	4	3	5	5	5	4.5
	Using the capacity of the local young and educated workforce	5	4	4	5	4	5	4	5	4	5	4.5
Weaknesses	Increase in energy consumption during the construction period due to more processes	4	5	5	4	3	5	5	5	5	4	4.5
	Non-observance of safety points and use of low-quality and low-durability materials	5	4	4	4	4	4	4	5	3	5	4.2
	General weakness in terms of management, expansion, and optimization of infrastructure in the region	5	5	5	4	5	5	5	5	5	4	4.8
	Lack of specific infrastructure facilities in project management	4	4	5	4	5	5	4	4	5	4	4.4
	The existence of worn-out fabric in the city center and the need to make setbacks in many urban passages	4	4	3	5	4	5	4	5	5	5	4.4
	The existence of a person-centered and partial attitude in contrast to a program-oriented attitude	5	3	5	5	5	4	5	4	4	5	4.5

(Continued)

(Continued)

		Delphi Technique/Third Round										
		Experts										
Criteria	Sub-criteria	1	2	3	4	5	6	7	8	9	10	Mean
Opportunities	Existence of potentials and potential geographical infrastructures for development and convergence in the regional space	5	4	5	4	4	5	5	4	3	4	4.3
	Attracting upstream resources to complete unfinished projects in urban construction plans	5	4	5	3	5	4	4	4	5	4	4.3
	Existence of laws and regulations to support construction projects	3	5	3	4	5	5	5	5	5	4	4.4
	Playing a collaborative role with NGOs in city management and planning	4	5	5	4	5	5	5	4	5	5	4.7
	Existence of expert and experienced personnel in construction project management	4	4	5	4	5	4	4	4	5	5	4.4
	The potential of creating popular participation due to the young population	5	5	4	4	5	3	5	4	4	5	4.4
	Government support and participation in construction projects	5	5	5	4	5	5	4	5	4	4	4.6
Threats	High costs of repair and maintenance of construction equipment	3	4	4	5	4	3	4	5	5	4	4.1
	Lack of integrated and coordinated management in the project	4	5	5	5	4	5	4	5	5	5	4.7
	The fragility of the environment in terms of the limitation of population settlement and economic activities	3	4	5	4	5	4	5	4	4	4	4.2
	The intervention of various organizations and legal abuses	4	5	4	4	4	5	5	5	4	5	4.5
	Lack of sufficient financial ability in the implementation of construction projects	4	5	4	5	4	4	5	5	4	4	4.4