

Original Article: The Role of Construction Plan in Sustainable Urban Development with Emphasis on Safety Indicators and Natural Risks of the City

Shahram Asadi Mehr¹, Neda Orak^{1*}

¹Department of Civil Engineering, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran



Citation Sh Asadi Mehr, N Orak, **The Role of Construction Plan in Sustainable Urban Development with Emphasis on Safety Indicators and Natural Risks of the City**, *EJCMPR*. 2024; 3(3):682-702

 <https://doi.org/EJCMPR/20240046>

Article info:

Received: 03 March 2024

Accepted: 10 Jun 2024

Available Online:

ID: EJCMPR-2406-1182

Checked for Plagiarism: Yes

Peer Reviewers Approved by:

Dr. Frank Rebout

Editor who Approved Publication:

Dr. Frank Rebout

Keywords:

Sustainable Urban Development, Sound Insulation, Quality of Materials, Construction Safety.

ABSTRACT

Nowadays, the activities of construction workshops are increasing day by day. The existence of various risks and harmful factors in these workshops has turned this industry into one of the most dangerous industries in the world. Given that the construction industry relies on human power by nature, and a healthy human being is considered the basic pillar of sustainable development. The purpose of this research was the role of construction plan in sustainable urban development with emphasis on safety indicators and natural risks of the city. In order to collect data, a questionnaire on the role of construction plans in sustainable urban development was used. The statistical population included municipal managers, supervisors of urban projects and urban affairs experts in 2021, and 384 people were selected based on Cochran's sampling method. The results have shown that in examining the impact of the type and quality of materials in construction related to the observance of sustainable urban development criteria, factors such as the level of attention to sound insulation in sustainable urban development, attention to green architecture as one of the components of sustainable urban development and the type and the quality of materials in construction has been prioritized. In examining the impact of using people without technical qualifications in terms of safety on sustainable urban development, factors such as the use of people with technical qualifications in the field of construction, the use of people with skills and experience, and local people according to the climatic conditions of the region have been prioritized.

***Corresponding Author: Neda Orak**

In the concept of sustainable development is an important change in the understanding of the relationship between humans, nature, and each other. This

issue is in conflict with the view of the past two centuries [1]; A point of view that is based on the separation of environmental, social and economic issues. It can be said that the sustainable development of sustainable

architecture aims to protect the environment by changing the approach towards nature, but the proposed solutions, which are manifested in the built environment today, are a kind of discrete treatment separated from nature, only for its preservation. Future generations will pay attention. Sustainable urban development is a form of reflection of today's development that guarantees the continuous development of cities and urban communities for future generations. The aggravation of environmental problems, the emergence and emergence of economic crises, social adversities and inequalities, the explanation of the direct relationship between the city form and sustainable development, and the need to design an appropriate management mechanism within the framework of sustainable urban management as effective historical roots in the formation and development of the theory of sustainable urban development by urban issues experts encouraged them to propose practical solutions and specific implementation measures in order to achieve sustainable cities. Today, risk management in construction projects is a very important management process in order to achieve project goals in terms of time, cost, quality, safety and compatibility with the environment. So far, researches have also been conducted in this field, but most of them have only focused on a number of different aspects of risk management in construction instead of using a systematic approach to identify risks and the probability of occurrence and effects of these risks [2]. The studies conducted in the field of industrial accidents have shown that the human factor plays the most important and main role in the occurrence of accidents, so that 60-90% of accidents occur as a direct result of human

errors and mistakes. Human error, as one of the most important types of unsafe behavior, is an inappropriate decision or behavior that can not only reduce the effectiveness, safety or performance of the system, but also cause personal and environmental risks. In this project, the researcher seeks to investigate the role of construction plan in sustainable urban development with emphasis on safety indicators and natural risks of the city.

Introduction of information gathering tools

In this research, according to the descriptive and analytical research method, while reviewing the available sources and information, while designing the questionnaire, the most important issues in the field of the role of construction in sustainable urban development with an emphasis on the safety indicators and natural risks of Ahvaz city considered and used in the design of the structured interview tool [2].

In terms of the descriptive and analytical nature of the current research, it will be appropriate to use the structured interview tool. In this research, to collect information from structured interviews in order to gather information from the statistical community (experts and senior and middle managers of Ahvaz municipality, public and private contracting companies of Ahvaz city and university professors) first to identify safety indicators and effective natural risks to sustainable urban development is considered as the basis of construction plan of Ahvaz city, and based on this, a structured interview plan is carried out.

Description of the data

Table 1. Frequency of age of respondents

		Abundance	Percent
Valid data	Less than 35 years	105	27.4
	36 to 45	133	34.7
	46 to 55	52	13.5

	56 and more	94	24.4
	Total	384	100

The survey showed that the largest age range was related to people aged 36 to 45 years.

Table 2. Frequency of respondents' education

		Abundance	Percent
Valid data	Associate Degree	124	32.3
	Bachelor's degree	141	36.7
	Masters	93	24.3
	P.H.D	26	6.7
	Total	384	100

The survey showed that the highest range of education level was related to people with bachelor's education level.

Table 3. The frequency of respondents' places of service

		Abundance	Percent
Valid data	Citizens	169	44
	Architectural experts	88	22.9
	Ahvaz Municipality	76	19.8
	University professors	51	13.3
	Total	384	100

The survey showed that the largest scope of the service was related to the citizens of Ahvaz.

Examining the fields and conditions for the realization of sustainable urban development design based on safety indicators and natural risks of Ahvaz city, Ahvaz city

Taking into account different design frameworks, the researcher has investigated the fields and conditions of realization of sustainable urban development design based on safety indicators and natural risks of Ahvaz city. To carry out this research, firstly, the criteria for measuring the potential of energy use, prioritization indicators of the construction plan in sustainable urban development with emphasis on the safety indicators and natural

risks of the city and construction have been extracted using the research literature. In this section, it is briefly mentioned the indicators of measuring the potential of energy use, the indicators of prioritization of the construction plan in sustainable urban development, with an emphasis on the safety indicators and natural risks of the city and unauthorized constructions.

The main variables for reviewing the prioritization of the construction plan in sustainable urban development with an emphasis on safety indicators and natural risks of the city and unauthorized constructions

Fuzzy weight obtained from fuzzy calculations using the weight obtained from each question:

The total weight calculated with the help of the software.

Main variables	Fuzzy weight obtained from fuzzy calculations
Implementation of the structure in terms of the number of floors with respect to the location	0.82
Contamination of the construction site or creating a large volume of waste	0.84
Project design error	0.83
Implementation of the structure in terms of the number of floors with respect to the location	0.59
The risk of the supervising engineer	0.71
Risk of worsening weather conditions	0.63
Non-compliance with the material standard	0.66
Ambiguity in the method of construction and continuation of work	0.59
Improper safety equipment for workers	0.78
Unlicensed building	0.82

(Weighting to determine the initial phases) types of sub-risks of illegal construction

Types of secondary risks of illegal construction	Fuzzy weight obtained from fuzzy calculations
Non-availability of the desired machinery	0.75
Failure to execute the work on time	0.74
The project implementation site is unknown in terms of geology and environmental situation	0.64
Clumsy approach and inexperience of the employer	0.64
Weakness of workshop planning	0.52
Little use of quality materials or no use	0.63
The risk of construction on the edge of the rivers	0.78
Workforce in terms of skills and allocation of the number of forces	0.73
Incompatibility of machines with application	0.59
The risk of non-compliance with safety standards in construction	0.66
Inadequacy of workload with manpower	0.81
The risk of building in urban green spaces	0.80
The risk of not complying with the number of floors proportional to the width of the alley and street	0.76
The risk of increasing the number of floors on unstable structures	0.71
The risk of non-compliance with manufacturing standards in worn fabric	0.79
Adverse working weather conditions	0.72
The risk of not complying with the permitted excavation	0.78

The risk of encroaching on the neighbors' privacy	0.85
The risk of building a commercial structure in a residential environment	0.63
The risk of exceeding the construction of internal spaces from the originally approved plan of the municipality	0.79
Risk of not having consulting engineers during construction	0.58
Work intensity and employee fatigue	0.81

In the next step

In order to draw the prioritization of the construction plan in sustainable urban development with emphasis on safety indicators and natural risks of the city and construction based on a significant level, the four main phases or the same as the four ranking priorities of the construction plan in sustainable urban development with emphasis It has been defined on the safety indicators and natural risks of the city and construction in different conditions for the area of Ahvaz city. Analysis table for ranking

the construction plan in sustainable urban development with emphasis on safety indicators and natural risks of the city and construction based on the types of risks, ranking the construction plan in sustainable urban development with emphasis on safety indicators and natural risks of the city and construction, the researcher explained each of the components based on the results of the respondents in the form of an analysis table.

Table 4. The most important role of construction plan in sustainable urban development with emphasis on safety indicators and natural risks of the city

Rank	Coefficient of variation (CV)	Rank average*	Standard deviation	Objects
1	0.026	3.51	0.913	Work intensity and employee fatigue
2	0.176	3.91	0.692	Non-availability of the desired machinery
3	0.184	3.87	0.715	Clumsy approach and inexperience of the employer
4	0.186	3.85	0.715	Weakness of workshop planning
The most important role of construction plan in sustainable urban development with emphasis on safety indicators and natural risks				
1	0.275	4.102	1.132	The project implementation site is unknown in terms of geology and environmental situation
2	0.277	4.238	1.188	Adverse working weather conditions
3	0.279	4.400	1.230	Risk of not having consulting engineers during construction
4	0.291	4.434	1.287	Failure to execute the work on time

Table 5. The most important role of the construction plan in sustainable urban development with emphasis on safety indicators and natural risks of the city: lack of ability of builders and citizens

Rank	Coefficient of variation (CV)	Rank average*	Standard deviation	Objects
1	0.236	3.88	0.916	The risk of not complying with the number of floors proportional to the width of the alley and street
2	0.239	3.52	0.842	The risk of non-compliance with manufacturing standards in worn fabric

3	0.239	3.84	0.918	The risk of encroaching on the neighbors' privacy
The most important role of construction plan in development				
1	0.308	4.132	1.275	The risk of construction on the edge of the rivers
2	0.308	4.442	1.371	Workforce in terms of skills and allocation of the number of forces
3	0.313	3.942	1.235	Incompatibility of machines with application
4	0.322	4.021	1.297	The risk of non-compliance with safety standards in construction
5	0.328	3.817	1.255	The risk of increasing the number of floors on unstable structures
6	0.330	4.457	1.473	The risk of building in urban green spaces

Data normality test results (Kolmogorov-Smirnov test)

Table 6. Results of data normality test

The significance level	The value of the statistic	
0.016	0.028	Type and quality of materials in construction
0.054	0.025	Using people without technical qualifications in terms of safety in the field of construction
0.07	0.033	Attention to green architecture as one of the components of sustainable urban development
0.063	0.029	The level of attention to sound insulation in sustainable urban development

Valid Kolmogorov-Smirnov test was used to test the normality of the residuals. The value is calculated. The Kolmogorov-Smirnov statistic for different variables is at the ideal level, for

which the P-value calculated by SPSS software is greater than 0.05, and therefore it can be said that the residuals of the regression have a normal distribution.

Examining the mean and deviation components of the studied range related to the variables

Table 7. Average values and deviation of the studied range related to the variables

Variables	Average	Deviation of the studied range
Type and quality of materials in construction	2.7667	0.98744
Using people without technical qualifications in terms of safety in	3.1889	1.0011
Attention to green architecture as one of the components of	3.4211	1.1544
The level of attention to sound insulation in sustainable urban	3.1644	1.0241

Table 8. Factor loadings and their significance level (interaction of fuzzy numbers) in summary in each component

Variable	Observed variables (items)	Fuzzy weight obtained from fuzzy calculations	The degree of mutual influence of fuzzy numbers	Final weight
Type and quality of materials in construction	X 1	0.62	0.51	0.819
	X 2	0.64		
	X 3	0.65		
	X 4	0.66		
	X 5	0.71		
	X 6	0.69		
Using people without technical qualifications in terms of safety in the field of construction	X 1	0.63	0.55	0.892
	X 2	0.72		
	X 3	0.70		
	X 4	0.74		
	X 5	0.73		
	X 6	0.72		
Attention to green architecture as one of the components of sustainable urban development	X 1	0.72	0.53	0.904
	X 2	0.71		
	X 3	0.75		
The level of attention to sound insulation in sustainable urban development	X 1	0.65	0.50	0.803
	X 2	0.67		
	X 3	0.70		
	X 4	0.71		
	X 5	0.64		

The investigation has shown that there is a correlation between all the questions of the main variables and the main variables with the dependent variable in the final weight values, the degree of mutual influence of the fuzzy numbers and the fuzzy weight obtained from the

fuzzy calculations. Therefore, it can be said that the criteria of sustainable urban development have been considered in Naderi area of Ahvaz. The survey showed that the criteria of attention to green architecture as one of the components of sustainable urban development and the use of

people without technical qualifications in terms of safety in the field of construction had higher weights than other criteria. Therefore, in the comparative analysis of localities, if these two

criteria were among the first to third criteria, it can be stated that that area had a higher intensity of sustainable urban development indicators.

Comparative study of areas of Ahvaz city

Table 9. Of ANOVA

Significance level	F	Mean square	Degrees of freedom	Sum of squares	
0.000	0.934	5.799 6.206	3 323 325	11.598 3843.387 414.985	Intergroup Within a group Total
0.000	0.243	1.538 6.337	3 323 325	15.075 411 91 429 985	Intergroup Within a group Total
0.000	0.877	1.155 5.952	3 323 325	24.222 432.52 456.742	Intergroup Within a group Total

In this study, we showed that the significance level and the F test were positive and correlated for all areas, and therefore, it can be stated that these areas have the criteria of sustainable urban development.

As mentioned, in the three phases of local risks, public risks and manpower risk, all types of risk components effective on the construction and sustainable development of Ahvaz city were examined. In this section, the fuzzy effect of the indicators of these total risks has been investigated based on the variables of the investigated hypotheses.

Fuzzy process analysis

Table 10. Fuzzy process analysis

General risks and human resources	Local risks and human resources
The project implementation site is unknown in terms of geology and environmental quality	Incompatibility of machines with application
Risk of worsening weather conditions	Workforce in terms of skills and allocation of the number of forces
Clumsy approach and inexperience of the employer	Workshop planning
Failure to execute the work on time	Use of poor materials
Ambiguity in the way of construction and continuation of work	Non-availability of the desired machinery
Complexity of work and lack of plan	Integrated planning, budgeting and implementation
Weakness of the supplier	Unsuitable working conditions

Project design error	Improper safety equipment for workers
Implementation of the structure in terms of the number of floors with respect to the location	Failure to use safety systems and tools during work
Contamination of the construction site or creating a large volume of waste	Work intensity and employee fatigue
Little use of quality materials or no use	Adverse working weather conditions
Advisory team and weak workshop support	Inadequacy of workload with manpower

The TOPSIS analysis process has several steps, each of which has a task within the framework of the overall process. The process of this process is such that the result of each step is considered as the data of the next step and the steps are arranged in series. These steps are:

- **First step:** Creating a hierarchy;
- **Second step:** Calculate the weight;
- **Third step:** System compatibility.

In this process, the health and safety of each step is necessary and the need is the desired result

and the acceptance of the next step. Therefore, the lack of accuracy in each of the steps causes a wrong process until the end of the process along with the data that is analyzed, and in this case the results will be scientifically rejected. In this research, in order to make our relative weights between the criteria and sub-criteria more realistic, instead of our linear criteria between them, non-linear risk identification indicators and main factors have been used.

The first investigated variable

Table 11. The effect of the fuzzy weight of using people without technical qualifications in terms of safety in the field of construction

Local (technical and operational) safety and construction risks	1	2	8
General risks (workspace) safety and construction	0.5	1	6
Safety risks of manpower of project implementation	1/8	1/6	1

Local (technical and operational) safety and construction risks	1	0.33	1/6
General risks (workspace) safety and construction	3	1	0.5
Safety risks of manpower of project implementation	4	2	1

Local (technical and operational) safety and construction risks	1	4	4
General risks (workspace) safety and construction	3	1	7
Safety risks of manpower of project implementation	0.25	1/7	1

Local (technical and operational) safety and construction risks	1	0.25	0.25
General risks (workspace) safety and construction	4	1	0.34
Safety risks of manpower of project implementation	6	3	1

Now, the relative weight of each of the options is obtained based on each of the criteria, and in order to reach these weights, the approximate method of normalization is used.

The second investigated variable

The effect of fuzzy weight, the effect of using people without technical qualifications in terms of safety in the field of construction

Table 12. The effect of fuzzy weight, the effect of using people without technical qualifications in terms of safety in the field of construction

Main risk factors	Local (technical and operational) safety and construction risks	General risks (workspace) safety and construction	Safety risks of manpower of project implementation
Local (technical and operational) safety and construction risks	1	2	8
General risks (workspace) safety and construction	0.5	1	6
Safety risks of manpower of project implementation	0.125	0.16	1
Fuzzy weight of using people without technical qualifications in terms of safety in the field of construction	13/8	19/6	15

Main risk factors	Local (technical and operational) safety and construction risks	General risks (workspace) safety and construction	Safety risks of manpower of project implementation	Average line
Local (technical and operational) safety and construction risks	0.615	0.631	0.533	0.593
General risks (workspace) safety and construction	0.308	0.316	0.4	0.341
Safety risks of manpower of project implementation	0.077	0.053	0.067	0.66
Total	1	1	1	1

The third investigated variable: The effect of fuzzy weight, the effect of paying attention to green architecture, sound insulation and recycled materials and energy storage as one of the components of sustainable urban development.

Table 13. The effect of fuzzy weight, the effect of paying attention to green architecture, sound insulation and recycled materials and energy storage as one of the components of sustainable urban development.

Main risk factors	Local (technical and operational) safety and construction risks	General risks (workspace) safety and construction	safety risks of manpower of project implementation
Local (technical and operational) safety and construction risks	1	0.33	0.25
General risks (workspace) safety and construction	3	1	0.5
Safety risks of manpower of project implementation	4	2	1
Fuzzy weight of the impact of paying attention to green architecture, sound insulation and recycled materials and energy storage as one of the components of sustainable urban development	8	10/3	7/4

Main risk factors	Local (technical and operational) safety and construction risks	General risks (workspace) safety and construction	Safety risks of manpower of project implementation	Average line
Local (technical and operational) safety and construction risks	0.125	0.1	0.143	0.123
General risks (workspace) safety and construction	0.375	0.3	0.286	0.32
Safety risks of manpower of project implementation	0.5	0.6	0.571	0.557
Total	1	1	1	1

Examining the mutual influence of variables

The effect of the type and quality of materials in construction × the effect of using people without technical qualifications in terms of safety in the

field of construction × the effect of paying attention to green architecture, sound insulation and recycled materials and energy storage as one of the components of sustainable urban development

Table 14. Examining the mutual influence of variables

The effect of time, quality and cost on project implementation	Local (technical and operational) safety and construction risks	General risks (workspace) safety and construction	Safety risks of manpower of project implementation
Local (technical and operational) safety and construction risks	1	4	4
General risks (workspace) safety and construction	3	1	7
Safety risks of manpower of project implementation	0.25	1/7	1
The effect of the type and quality of materials in construction × the effect of using people without technical qualifications in terms of safety in the field of construction × the effect of paying attention to green architecture, sound insulation and recycled materials and energy storage as one of the components of sustainable urban development	17/4	36/7	12

The effect of time, quality and cost on project implementation	Local (technical and operational) safety and construction risks	General risks (workspace) safety and construction	Safety risks of manpower of project implementation	Average line
Local (technical and operational) safety and construction risks	0.235	0.778	0.333	0.449
General risks (workspace) safety and construction	0.706	0.194	0.583	0.494
Safety risks of manpower of project implementation	0.059	0.28	0.84	0.57
Total	1	1	1	1

Now, after obtaining the relative weight of the options in relation to each of the criteria, the relative weight of the criteria is compared in pairs, which according to the use of the theory of

desirability instead of the identification indicators and the main factors of linear risk, we act as follows.

A) The identification indicators and the main risk factors of the final replacement rate of both criteria are obtained in pairs through DM.

Table 15. As a result, we have options for the final weight

Relative weight of options	Main risk factors	Main risk factors	The effect of time, quality and cost on project implementation
Local (technical and operational) safety and construction risks	0.593	0.123	0.449
General risks (workspace) safety and construction	0.341	0.32	0.494
Safety risks of manpower of project implementation	0.066	0.557	0.57

$$(0/56 \times 0/593) + (0/39 \times 0/123) + (0/01 \times 0/087) + (0/04 \times 0/449) = 0/398$$

$$(0/56 \times 0/341) + (0/39 \times 0/32) + (0/01 \times 0/274) + (0/04 \times 0/494) = 0/338$$

$$(0/56 \times 0/066) + (0/39 \times 0/557) + (0/01 \times 0/639) + (0/04 \times 0/57) = 0/283$$

As a result

0.398 local risks (technical and executive) safety and construction=Option

0.338 general risks (work space) safety and construction=Option

0.283 Human safety risks of project implementation=Option

deviation is sensitivity analysis, which combines sensitivity analysis techniques and statistical analyzes in providing diverse and optimal combinations to create a vision of the best combination in the main risk factors based on the identification indicators and the main risk factors. Using fuzzy multi-criteria decision-making model has been more successful than other techniques.

Data sensitivity analysis

The most widely used techniques provided to check the level of data strength and their level of

Table 16. Data sensitivity analysis

Relative weight of options	Generalization variables	The optimal value of the run time rating	Execution time	Amount of deviation
Type and quality of materials in construction	X1- X3	0.398	0.359	+0.39
Attention to green architecture, sound insulation and recycled materials and energy storage as one of the components of sustainable urban development.	X4- X6	0.338	0.303	+0.35

People without technical qualifications in terms of safety in the field of construction	X7- X9	0.283	0.261	+0.22
---	--------	-------	-------	-------

In the results, it can be shown that the deviation of the obtained values compared to the standard conditions and in the conditions where they were not used in the risks on the construction plan in the sustainable development of Ahvaz, was at a more optimal level, and therefore in the sensitivity analysis, it was positive and they have acted effectively.

Discussion

The general purpose of this research was to identify and rank the factors affecting the construction plan in sustainable urban development with an emphasis on safety indicators and natural risks of the city and unauthorized constructions in the city of Ahvaz and providing solutions to limit them. In this research, questions related to the topic of the research were raised [3], which include the construction plan in sustainable urban development with an emphasis on safety indicators and what are the common natural risks of the city in Ahvaz? Which risks are the most frequent and most impactful? Has time influenced the type of risks? What are the causes of various construction risks in Ahvaz city? What are the strategies that can be used to limit risks? This research was considered to be a

descriptive, analytical and applied research with regard to the investigation of the construction plan in sustainable urban development with emphasis on the safety indicators and natural risks of the city and unauthorized constructions in construction projects [4]. In this research, according to the different construction standards, it is necessary and necessary to plan a comprehensive approach based on the following. Considering the opinions of elites to collect information, a number of open questions in the form of questions from the statistical sample regarding It was asked about the factors affecting the construction plan in sustainable urban development with emphasis on the safety indicators and natural risks of the city and unauthorized constructions and providing solutions to limit them [5].

Examining the results of research hypotheses

The first hypothesis: The type and quality of materials in construction are effective on sustainable urban development with an emphasis on safety indicators and natural risks of the city.

Standard deviation	Average	Pearson test	The significance level	Independent variable
1.023	3.456	0.025	0.000	Type and quality of materials in construction

The results of the investigation of this hypothesis showed that according to the significance level obtained equal to 0.000 and Pearson's test which showed a value equal to 0.025, it can be stated that at the alpha level of error equal to 0.05, the value of Pearson's test was at a lower level, but in an alpha level of error

of 0.01 indicates a higher value [6]. Therefore, it can be concluded that at the probability level of 0.05%, the result of the test is confirmed and it is possible to show a significant relationship between the independent and dependent variables. Therefore, the hypothesis is confirmed [7].

Evaluation of compliance with sustainable urban development criteria

Comparative evaluation of compliance with sustainable urban development criteria using the coefficient of variation (C.V) index.

Table 17. Comparative evaluation of compliance with sustainable urban development criteria using the coefficient of variation (C.V) index

Rank	Coefficient of variation (C.V.)	Standard deviation	Average	equirements
1	0.388	2.35	4.95	The level of attention to sound insulation in sustainable urban development
2	0.394	2.51	4.87	Attention to green architecture as one of the components of sustainable urban development
3	0.430	2.57	3.97	Type and quality of materials in construction
4	0.438	2.39	3.46	Using people without technical qualifications in terms of safety in the field of construction

The survey has shown that the level of attention to sound insulation in sustainable urban development, attention to green architecture as one of the components of sustainable urban development are in the first to third priorities. The investigation has shown that in this area, the important criteria of sustainable urban development have been observed and therefore it can be stated that out of the two important criteria with high weight, i.e. the criteria of attention to green architecture as one of the components of sustainable urban development and the use of people without technical qualifications In terms of safety in the field of construction, the only criteria for paying attention to green architecture as one of the components of sustainable urban development has been in the first three priorities [8].

In the research of Gholizadeh, in line with the results of this research in 2020, it was shown

that the identified risks were provided to specialists and experts in the field of building safety through a questionnaire [9].

The most important risks extracted from the FUZZY TOPSIS method are related to the collision of the crane arm with the building and people slipping and falling from the staircase ramp [10].

In the FUZZY FMEA method, the risks related to people falling from the edge of the excavation, slipping and falling from the staircase ramp, and falling from the scaffolding and work stations have the highest rank. The most important risks identified in the construction industry in two ways, including people falling from the edge of the excavation, slipping and falling from the staircase ramp and falling from the scaffolding, work stations, the crane arm hitting the building, and people slipping and falling from the staircase ramp [11].

The second hypothesis: The use of people without technical qualifications in terms of safety is effective on sustainable urban development with an emphasis on safety indicators and natural risks of the city.

Table 18. The use of people without technical qualifications in terms of safety is effective on sustainable urban development with an emphasis on safety indicators and natural risks of the city

Standard deviation	Average	Pearson test	The significance level	Independent variable
1.345	4.11	0.018	0.000	Using people without technical qualifications in terms of safety

The results of the investigation of this hypothesis showed that according to the significance level obtained equal to 0.000 and Pearson's test which showed a value equal to 0.018, it can be stated that at the level of error alpha equal to 0.05, the value of Pearson's test was at a lower level, but in an alpha level of error of 0.01 indicates a higher value. Therefore, it can be concluded that at the probability level of 0.05%, the result of the test is confirmed and it

is possible to show a significant relationship between the independent and dependent variables. Therefore, the hypothesis is confirmed [12].

Comparative evaluation of compliance with the criteria of using people without technical qualifications in terms of safety on sustainable urban development

Table 19. Comparative evaluation of compliance with the criteria of sustainable urban development in using coefficient of variation (C.V) index

Rank	Coefficient of variation (C.V.)	Standard deviation	Average	Requirements
1	0.371	2.36	4.75	Using people with technical qualifications in the field of construction
2	0.382	2.27	4.53	Use of skilled and experienced people
3	0.385	2.18	4.29	Native people suited to the climatic conditions of the region

The investigation has shown that the use of people without technical qualifications in terms of safety in the field of construction, paying attention to the use of people with technical qualifications in the field of construction as one of the components of sustainable urban development and the use of people with skills and experience and local people are appropriate. With the weather conditions of the region, they have been in the first to third priorities. The investigation has shown that in this field, the important criteria of sustainable urban development have been observed, and therefore it can be stated that considering the use of

people with technical qualifications in the field of construction has been considered as one of the components of sustainable urban development [10].

In Shayanfar's research, in line with the results of this research in 2019, the results of the research indicated the optimal efficiency of the proposed model in evaluating the safety risks of construction projects, so that the error rate of the model is acceptable. Also, the model can provide an efficient tool for project managers in evaluating and refining the safety situation in the construction site [13]. By increasing safety and its organization, the risk of closing down

workshops due to lack of safety is reduced and productivity management in construction workshops is increased.

The third hypothesis: Attention to green architecture is effective on sustainable urban development with emphasis on safety indicators and natural risks of the city.

Table 20. Attention to green architecture is effective on sustainable urban development with emphasis on safety indicators and natural risks of the city.

Standard deviation	Average	Pearson test	The significance level	Independent variable
1.41	4.55	0.042	0.000	Attention to green architecture

The results of the investigation of this hypothesis showed that according to the significance level obtained equal to 0.000 and the Pearson test which showed a value equal to 0.042, it can be stated that at the level of alpha error equal to 0.05, the value of the Pearson test was at a lower level, but in an alpha level of error of 0.01 indicates a higher value. Therefore, it can be concluded that at the probability level of

0.05%, the result of the test is confirmed and it is possible to show a significant relationship between the independent and dependent variables. Therefore, the hypothesis is confirmed [14].

Comparative evaluation of compliance with green architecture on sustainable urban development

Table 21. Comparative evaluation of compliance with the criteria of sustainable urban development in using coefficient of variation (C.V) index

Rank	Coefficient of variation (C.V.)	Standard deviation	Average	Requirements
1	0.355	2.35	4.29	Type and quality of materials in construction
2	0.342	2.11	4.05	Using people without technical qualifications in terms of safety in the field of construction
3	0.333	1.94	3.86	The level of attention to sound insulation in sustainable urban development
4	0.318	1.65	3.79	Attention to green architecture as one of the components of sustainable urban development

The survey has shown that the type and quality of materials in construction and the use of people without technical qualifications in terms of safety in the field of construction were in the first to third priorities. The investigation has shown that in this area, the important criteria of sustainable urban development have been

observed and therefore it can be stated that out of the two important criteria with high weight, i.e. the criteria of attention to green architecture as one of the components of sustainable urban development and the use of people without technical qualifications in terms of safety in the field of construction, only the use of people

without technical qualifications in terms of safety in the field of construction has been in the first three priorities. In the year (2019), Movafagh showed that after determining the scope of study and identifying social [14], economic and health characteristics, safety and health risks were identified, and the number of 9 health risks and 8 safety risks were identified, in health risks, about 68% of them were at an acceptable level and 32% were at an acceptable level under the condition of control. In terms of safety risks, about 6% are at an unacceptable level, 6% are at an unfavorable level, 50% are at an acceptable level under the condition of

control, and 38% are at an acceptable level. Among the most important health risks are vision damage caused by welding, hearing damage caused by sounds in construction sites, and skin and respiratory damage caused by working with chemicals and carcinogens. People are working from falling from a height and objects falling on people. And finally, corrective measures and suggestions have been presented to reduce, eliminate or minimize the risks, among which the use of personal protective equipment can be mentioned among the control measures [13].

The fourth hypothesis: The level of attention to sound insulation is effective on sustainable urban development with an emphasis on safety indicators and natural risks of the city.

Table 22. The level of attention to sound insulation is effective on sustainable urban development with an emphasis on safety indicators and natural risks of the city

Standard deviation	Average	Pearson test	The significance level	Independent variable
1.41	4.55	0.039	0.003	Attention to sound insulation

The results of the investigation of this hypothesis showed that according to the significance level obtained equal to 0.003 and the Pearson test which showed a value equal to 0.039, it can be stated that at the level of alpha error equal to 0.05, the value of the Pearson test was at a lower level, but in alpha error level of 0.01 shows a higher value, so it can be concluded that the test result is confirmed at the probability level of 0.05% and a significant relationship can be shown between the independent and dependent variables. Therefore, the hypothesis is confirmed.

In line with the results of this research, Mark (2020) showed that in a case study of conventional construction workshops, twenty activities with risk potential, ten accidents caused by these activities and twelve accident factors were identified and using the judgment of safety experts and project supervisors was evaluated through a questionnaire. Finally, excavation activities and work at height were recognized as the most dangerous activities in terms of safety, and solutions were also provided to improve and prevent accidents caused by these activities [11].

The fifth hypothesis: The use of recycled materials is effective on sustainable urban development with an emphasis on safety indicators and natural risks of the city.

Table 23. The use of recycled materials is effective on sustainable urban development with an emphasis on safety indicators and natural risks of the city

Standard deviation	Average	Pearson test	The significance level	Independent variable
1.58	4.74	0.019	0.000	Use of recycled materials

The results of the investigation of this hypothesis showed that according to the significance level obtained equal to 0.000 and Pearson's test which showed a value equal to 0.019, it can be stated that at the alpha level of error equal to 0.05, the value of Pearson's test was at a lower level, but in an alpha level of error of 0.01 indicates a higher value. Therefore, it can be concluded that at the probability level of 0.05%, the result of the test is confirmed and it is possible to show a significant relationship between the independent and dependent variables. Therefore, the hypothesis is

confirmed. In line with the results of this research, Lee (2021) showed that the applicability of the proposed model was investigated by implementing the model in a construction project in Tehran. The risk assessment of the case study has been done from the point of view of the employer, consultant, contractor, and finally by considering all the stakeholders of the project [10]. The results show the ability to use the presented model in analyzing the risks affecting the important parameters of cost, time, quality and safety in the implementation of construction projects.

Sixth hypothesis: Paying attention to energy saving is effective on sustainable urban development with emphasis on safety indicators and natural risks of the city.

Table 24. Paying attention to energy saving is effective on sustainable urban development with emphasis on safety indicators and natural risks of the city

Standard deviation	Average	Pearson test	The significance level	Independent variable
1.11	3.90	0.022	0.000	Attention to energy storage

Conclusion

The results of the investigation of this hypothesis showed that according to the significance level obtained equal to 0.000 and the Pearson test which showed a value equal to 0.022, it can be stated that at the alpha level of error equal to 0.05, the value of the Pearson test was at a lower level, but in an alpha level of error of 0.01 indicates a higher value. Therefore, it can be concluded that at the probability level of 0.05%, the result of the test is confirmed and it is possible to show a significant relationship between the independent and dependent variables. Therefore, the hypothesis is confirmed. Hajizadeh identified and ranked safety risk in construction workshops in Tehran

with a combined approach in 2020. In this Hamraestan research with the current research, it was shown that in the first stage, safety indicators and natural risks and activities that are a subset of risks were extracted by using the study and review of related specialized books and articles, out of which 7 risks were identified separately from 93 activities. By using the method of analyzing the failure factors and its effects, FMEA and the values related to the identified risks and the parameters of the probability of the occurrence of risks, the severity of the risk and the probability of discovering the risk, and using the relevant tables, the value of the priority of the risks was obtained. RPN values were greater than 44.

Therefore, we do not have an acceptable risk, and according to this figure, all risks are moderate and unacceptable. Therefore, all activities should be considered in the ranking stage and 93 activities should be prioritized according to risks. Therefore, in the next step, activities were prioritized according to safety indicators and natural risks using the Electra method. In the first stage, the method of hierarchical analysis process was used to determine safety indicators and natural risks, and the results showed that falling from a height has a weight of 4221, falling objects and materials has a weight of 4219, electrocution has a weight of 429, explosion and fire has a weight of 4212, collision with machinery has a weight of 4240, falling of materials has a weight of 4247 and gas inhalation has a weight of 4243. In the next step, the activities were prioritized and the results showed that falling from a height while moving people on the floors and areas and carrying materials on the floors, electrocution while working with electric hand tools, collision with industrial machines during excavation and transportation operations are given priority. According to the investigations made from the database of accidents caused by work in the General Directorate of Labor Inspection of the Ministry of Cooperation, Labor and Social Welfare, it can be concluded that the findings of the research in identifying the priority risks are valid and the safety officials can benefit from this model in risk assessment.

References

- [1]A Pour Ahmad, et al., Pathology of urban development plans in the country. Geographical Researches, **2006** 167-180. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [2]A Nikpour, et al., Investigation and analysis of the relationship between social capital and construction risks (Case study: Citizens of Babolsar city), Shahr Magazine, **2015** 2(3): 113-126, [[Google Scholar](#)], [[Publisher](#)]
- [3]M Zokaei., Collaborative Urban Development: Muslim Bin Aghil Neighborhood, Municipalities Monthly, **2002** 48:39 – 54 [[Google Scholar](#)], [[Publisher](#)]
- [4]S Salehi Milani, M Mohammadi, Compilation of construction rules and regulations in - mountainous areas (case study: Bagh Shater neighborhood of Tehran), Art University Quarterly, **2010** 3:97. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [5]E Sarkhaili, M Rafieyan, Investigating the risk motivations of constructing a building in excess of building density in Tehran, Urban Management, **2012** 20: 162-145. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [6]E Sarkhaili, M Rafieyan, M.R Bemanian, Investigating the relationship between building risk of change of use and the spatial structure of Tehran using spatial regression analysis. Journal of Architecture and Urbanism, **2014** 12: 41-23. [[Google Scholar](#)], [[Publisher](#)]
- [7]A Saeednia, Autopsy of the comprehensive plan of Tehran. Negar city, **2013** 59: 14-29. [[Google Scholar](#)], [[Publisher](#)]
- [8]E Sarkheyli, M Rafieian, Assessing Tehran's Urban Structure Effects on Non-Compliance with FAR Regulation. Armanshahr Architecture & Urban Development, **2013** 5(10): 223-238. [[Google Scholar](#)], [[Publisher](#)]
- [9]L Tian, T Shen, Evaluation of Plan Implementation in the Transitional China: A Case of Guangzhou City Master Plan. Cities, **2011** (28): 11-27. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [10] Z Zegarac, Illegal construction in Belgrade and the prospects for urban development planning. Cities, **1999** 16(5): 365–370. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [11] R Nallathiga, Development Planning or Development Control the Changing Focus of Master Plan of Mumbai. ITPI Journal, **2018** 3 (4): 28-35. [[Google Scholar](#)], [[Publisher](#)]

- [12] V Ogu, Housing enablement in a developing world city: the case study of Benin City. Nigeria. Habitat International, **1999** 23(2): 231–248. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [13] A Kumar, Problems and prospects of building regulations in Shimla, India – A step towards achieving sustainable developmen, International Journal of Sustainable Built Environment, **2017** 6, 207–215. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [14] L Melchert, The Dutch sustainable building policy: A model for developing countries? Building and Environment, **2007** (42): 893–901. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

This journal is a double-blind peer-reviewed journal covering all areas in Chemistry, Medicinal and Petroleum. EJCMPR is published quarterly (6 issues per year) online and in print. Copyright © **2024** by ASC ([Amir Samimi Company](#)) which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.