Using the identifying and analyzing effective defence factors in the vulnerability of Andisheh planned new town and developing a scenario to deal with natural and human threats

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Abstract

Cities undergo changes and transformations according to their geographical location and human and natural factors. In this regard, they experience various natural and human threats and crises. Therefore, strategies and effective factors should be identified and used by the threats. In this context, it is essential to emphasize defence factors and reduce vulnerability. In this research, the aim is to identify and analyze the effective defence factors in the vulnerability of the new city of Andisheh and then develop a scenario to deal with natural and human threats. The descriptive-analytical research method is based on data collection from library and field methods. The field data collection method was a questionnaire, the validity of which was confirmed through elites and its reliability with Cronbach's alpha greater than 0.70. The statistical population of the research was also formed by experts and elites of urban management in Andisheh City, and 50 people were determined as the sample size. Analyzes were performed with prospective tools such as interaction effects analysis and Mic Mac software. The result showed that 50 factors are known in the subject field. The analysis of the results shows that the factors of reducing the city's reserve lands with the establishment of new uses as well as non-observance of the prohibitions of dangerous uses are among the important influencing factors, and on the other hand, the variables of increasing migration to Andisheh city as well as non-observance of defence and crisis management standards as The most important influencing factors are known. To reduce the vulnerability of Andisheh city, 10 scenarios have been proposed, and based on the results, 4 scenarios include one scenario as the strongest scenario, one scenario as a favourable trend, and two scenarios as critical scenarios, as possible scenarios to reduce the vulnerability of the new city of Andisheh. were chosen. With the realization of each of the scenarios, the city's vulnerability will change. The strongest scenario has a lot of emphasis on improving the indicators, including increasing the use of urban reserve lands, complying with the prohibitions of dangerous uses, and controlling the growth of immigration in a short schedule.

Keywords: defense, vulnerability, planned cities, crisis, Andisheh planned new town
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1 Introduction

Every year, crises cause great and sometimes irreparable damages to countries and human societies by adversely affecting the three indicators of society, economy, and environment [17]. The basic priorities of all governments are

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that due to the extent and complexity of societies as well as the diversity and multiplinew town of crisis factors, the use of traditional methods of resilience and dealing with crises is no longer very effective [9]. Therefore, during the past few decades, the rapid urban growth and development of urban areas has caused their vulnerability to crises of human and natural origin to be considered more than before [22]; Because urban growth increases the level of vulnerability if different dimensions and their development are not paid attention to. In line with this issue, the crisis management approach in cities was emphasized and special planning was done. Being able to minimize the damage with a proper crisis management is always one of the important issues of urban planning and development [3]. In order to make a policy to reduce the vulnerability of urban spaces to natural and human hazards and the need to make correct decisions and implement operations according to it, and also considering the progress of human knowledge and technology, to provide a clear picture of the consequences of hazards, management review Crisis is necessary. This survey and planning is the most efficient or perhaps the best option for new town management and planning [16].

Although many urban crises cannot be predicted, with proper planning and preparation, their effects can be reduced [21] and serious damage can be prevented. For prevention in urban crisis management, careful planning and used systematically [20]. This includes risk analysis, hazard identification, training and preparation of people, creating the necessary infrastructure, preparing and supplying the necessary equipment and materials, improving the capanew town and capabilities of the executive bodies, and building a culture to create a collective will to prevent and deal with urban crises [4]. Today, one of the most important issues in the field of crisis management and vulnerability reduction is the issue of passive defense and applicable and anticipated measures in this regard. Passive defense is one of the most important approaches and strategies in the field of urban crisis management. Safety and security have long been considered in the planning and management of urban settlements. Looking at the existing political structure and atmosphere and the military paradigms in urban areas, it seems necessary to take into account the measures of the passive defense system in the context of a comprehensive view in order to increase the power and authority of the system and reduce the physical and human vulnerabilities from aggression. possibility, the possibility of happening [1]. Passive defense includes actions taken in cities and urban areas to reduce damages and injuries caused by various crises. These measures include planning, training and awareness raising, provision of equipment, creation of structures related to crisis management and coordination between different agencies in times of crisis [7]. As a result, defense and actions in this field are effective in crisis management.

The issue of crisis management and paying attention to passive defense is very important in planned cities; Because the urban growth and expansion of urbanization in planned cities is increasing rapidly, and if crisis management and passive defense indicators are not paid attention to, these cities will also find a situation similar to many metropolises [15]; Because in terms of crisis management, metropolises are facing extensive challenges and solving their problems is difficult in terms of time, place, cost, etc. Planned cities are highly prioritized in terms of vulnerability and becoming national crises in the event of human and natural hazards [8]. The relatively high population density, the dependence of planned cities on metropolitan areas, the high ratio of zones and residential units to other uses are all the reasons for this concern [14]. Generally, such places are compared to the older parts of existing cities. It is associated with residents' confidence in the state of structures, urban structures and urban facilities and infrastructures [10]. Also, one of the other characteristics of such areas is the high population density at night, which increases the probability of vulnerability in times of potential crisis. While the construction and development of such settlements has imposed a high financial and non-financial cost on the governments. Therefore, efficiency and effectiveness will be as expected [5]. Therefore, the problem of the research is that planned cities need basic attention in the field of crisis and defense measures. Reducing vulnerability in times of crisis is essential for these cities. Therefore, some factors such as defense factors should be promoted in these cities or the effective factors in this field should be identified and emphasized and planned. Another point is that the reduction of natural and human damage and threats requires a proper understanding of the new town and the effective factors in its development from various economic, social, environmental, physical, management, etc. aspects. Therefore, in the first stage, the recognition of effective defense factors in the vulnerability of planned cities and in the second stage, the development of effective strategies and scenarios in reducing threats should be emphasized.

In this study, Andisheh planned new town has been selected as the case study. Andisheh planned new town is located and designed in 30 kilometers from the western axis of Tehran (from Azadi Square) to accommodate a part of Tehran's population overflow, based on the latest resolution of the Supreme Council of Architecture and Urban Planning in 2003, the detailed plan of this new town with a population of 118,000 people and It was approved in a land with an area of about 1400 hectares. Considering that this new town is considered a new new town and one of the planned cities, in terms of crisis management and passive defense measures, it should emphasize the necessary conditions and provisions. How much resistance and defense power does this new town have during a crisis? Because it accommodates a large part of the population and various services, and it is expected that it will have good

efficiency and performance even in times of crisis. Based on this, various factors play a role in this field, which is very important and necessary to know and analyze. Part of these factors are defense factors, which are different from other cities according to the geographical location of Andisheh planned new town, as well as potentials, limitations and other criteria. Therefore, what are the effective defense factors for this new town and how can it help to reduce the vulnerability of this new town in times of crisis and various threats, is one of the key and fundamental issues. Therefore, the aim of this research is to identify and analyze effective defense factors in the vulnerability of Andisheh planned new town and then develop a scenario to deal with natural and human threats.

2 Methodology

The research method is descriptive-analytical and based on the collection of field and documentary-library data. In order to know the effective defense factors in the vulnerability of Andisheh planned new town, it was investigated in various related studies and documents. In this section, by referring to urban development plans such as the comprehensive and detailed plan of Andisheh planned new town, physical components and urban land uses were examined. Then, in the next step, the effective and key factors in this field were compiled and collected. In the following, the identified factors were evaluated and analyzed in the form of a quantitative method. The statistical community of this research is made up of urban management experts of Andisheh planned new town. According to the snowball method, the number of 50 urban experts was determined as the sample size. The data collection method was the ISM questionnaire. In order to analyze various factors, forecasting methods have been used in MIC MAC software. The validity of the questionnaire was confirmed by 10 elites and its reliability was confirmed by completing 30 questionnaires outside the statistical sample, with Cronbach's alpha coefficient greater than 0.70. Future planning tools such as mutual effects analysis and MIC MAC software have been used to develop strategies.

In an ISM questionnaire matrix, the relationship of variables should be checked 2 by 2. For example, variable A and variable B can have a two-way or one-way relationship, or basically have no relationship. The types of relationships between variables in structural-interpretive modeling are as follows:

- V symbol: variable i affects variable j.

- Symbol A: variable j has an effect on variable i.

- Symbol X: variable i and variable j have two-way relationship.

- Symbol O: variable i and variable j have nothing to do with each other.

In this questionnaire, since all variables are compared two by two, the number of elements cannot be considered too high and above 30. Therefore, after collecting the questionnaires, the experts' opinions were gathered. Aggregation of opinions was done based on the frequency of opinions. Experts use four symbols to determine the relationship between two sub-processes. Each symbol has a specific meaning:

1. V (pre) means that factor a is a prerequisite for factor b. The output of a is the input of b.
2. A (so) means that factor a is a prerequisite for factor b. a takes its input from b.
3. X (both) means that factors a and b are needed. They give input and output to each other.
4. O (B) means that factor a and factor b are unrelated. Neither a nor b input to each other.

Finally, the result of the comments was calculated, which is presented in the following table:

2.1 Creation of the achievement matrix

By converting the relationship symbols of the SSIM matrix to the numbers zero and one according to the following rules, the achievement matrix can be reached. These rules are as follows: a) If the house (i,j) in the SSIM matrix has the symbol V, the corresponding house in the access matrix gets the number 1, and the corresponding house, i.e. the house (j,i) gets the number zero. b) If the house (i,j) in the SSIM matrix has the symbol A, then the corresponding house in the access matrix will get the number 0, and its relative house, i.e. the house (j,i) will get the number 1. c) If the house (i,j) in the SSIM matrix has the symbol X, the corresponding house in the access matrix gets the number 1, and its relative house, i.e. the house (j,i) gets the number 1. d) If the house (i,j) in the SSIM matrix has the symbol O, the corresponding house in the access matrix gets zero, and its relative house, i.e. house (j,i) also gets zero.

Table 1: The result of opinions about the relationship between factors

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
	X	X	V	O	O	O	V	A	O	O	O	O	O	V	O	O	O	O	O	1
		O	O	A	O	A	X	A	X	O	A	A	A	A	A	O	A	A	A	2
			A	A	X	A	O	A	O	X	A	A	A	A	X	A	X	A	O	3
				O	O	O	V	A	A	V	A	X	X	V	X	X	V	X	V	4
					V	X	V	A	V	O	O	O	O	V	O	O	O	A	V	5
						X	O	A	V	V	O	O	O	X	O	O	V	O	V	6
							V	X	O	O	A	V	O	X	O	O	O	X	A	7
								A	A	O	O	O	O	O	A	O	A	A	O	8
									V	V	V	O	O	O	V	O	V	V	V	9
										X	A	O	O	X	X	V	V	X	X	10
											A	O	O	A	A	O	O	X	A	11
												O	O	O	V	O	V	V	V	12
													X	V	X	O	X	X	O	13
														V	V	O	X	X	O	14
															X	V	X	X	V	15
																X	X	A	X	16
																	A	A	O	17
																		X	V	18
																			X	19
																				20

2.2 Introduction of the studied new town

Andisheh planned new town is located in the southern plains of the Alborz mountain range, which is located at 35 degrees and 42 minutes north and 51 degrees and 2 minutes west, adjacent to Alborz and Tehran provinces. The height of this area is 1200 meters above sea level. Andisheh planned new town is one of the cities of Tehran province in Iran. This new town is located in the central part of Shahriar new town. This new town is located 30 kilometers from Tehran, 3 kilometers northwest of Shahriar and 7 kilometers southeast of Karaj. This new town has 6 phases, phase two, three, four, and five of Andisheh planned new town, which was designed and built based on new urban planning laws. At first, Andisheh planned new town was built as a controller for the population overflow of Tehran metropolis, but now it has progressed towards commercialization. It is also a leading new town in the west of Tehran province in terms of culture, art and sports. With its facilities, this new town can help improve the air temperature and can balance and cool the air in the new town. These facilities and systems have been produced in a very advanced form, similar or modeled after its advanced external cooling system in Andisheh planned new town. According to the 2016 census, the population of this new town was equal to 116,063 people. Its area is also reported to be 1495 hectares.

3 Research findings

Identification of key effective defense factors in the vulnerability of Andisheh planned new town against natural and human threats. As mentioned, effective defense factors were identified from the document analysis method as well as the points mentioned by the experts and were further evaluated and investigated. Based on the studies of the existing situation of Andisheh planned new town, 50 factors as effective defense factors in the vulnerability of Andisheh planned new town against natural and human threats have been identified and analyzed with MIC MAC software.

3.1 Forming the matrix of identified factors in MIC MAC software

The dimensions of the matrix are 50×50. The filling degree of the matrix is 46.8%, which shows that the selected factors have a dispersive effect on each other. Out of the total of 1170 evaluable components in this matrix, 1330 components were zero, which means that the factors do not affect each other or from each other. 215 relationships, their number was one. This means that they had a little influence on each other. 402 relationships, their number was 2, which means that they had a relatively strong influencing relationship. 92 relationships, their number was 3, which means that the relationships of the key factors were very high and they had a lot of influence and influence. Finally, there were 344 relations, whose number was P, which indicated the potential and indirect relations of the factors.

Table 2: Initial analysis of matrix data and cross effects

Indicator	Value
Matrix dimensions	50
The number of repetitions	2
Number zero	1330
Number one	215
Number two	402
Number three	209
The number of P	344
Total	1170
Degree of filling (percentage)	46.8

3.2 System analysis and interrelationships of factors

In the cross matrix, the sum of the row numbers of each variable, the degree of influence and the column sum of each variable also shows the degree of influence of that variable from other variables. The distribution and distribution of variables in the distribution plane indicates the stability or instability of the system. In the methodology and analysis section of MIC MAC, two types of dispersion are defined, which are known as stable systems and unstable systems. In stable systems, three categories of variables can be observed. Variables highly influencing the system (key factors); independent variables; System output variables (result variables).

As can be seen in the output of the system, the distribution of variables affecting the vulnerability of Andisheh planned new town against possible threats shows that the instability situation in the whole new town is more influenced by independent variables. It is necessary to mention that MIC MAC software and the method of cross matrix analysis were used only to extract key effective factors on the vulnerability of Andisheh planned new town. In total, the variables investigated in this research are the variables with direct effect.

3.3 Direct effect of variables on each other

1. **Determining or affecting variables**: the presence of several affecting factors near the northwestern region of the diagram shows that several factors are influencing the whole new town in relation to vulnerability. The possibility of the new town responding to possible threats for emergency evacuation; Failure to comply with the prohibitions of dangerous uses in parts of the new town, especially the high-density centers of Andisheh planned new town; lack of a specific frequency on the radio of the regional officials during the crisis; The increase in immigration to Andisheh planned new town and the formation of wide ethnic diversity in this planned new town; The absence of underground tunnels for urban facilities and equipment and the use of this equipment on the ground in the whole of Andisheh planned new town. These variables are the most important influencing factors on the vulnerability of Andisheh planned new town against potential threats. As can be seen in the output distribution of the direct effects of MIC MAC software, 5 key influencing factors are located in the northwest region. These factors affect the whole new town (Fig. 1).

2. **Dichotomous variables**: these variables have two common characteristics of high influence and high influenceability, and any action on them will change other variables as well. These variables can be divided into two categories: risk and target variables.

   (a) Risk variables: As shown in Fig. 2, these variables should be placed above the diagonal line of the northeastern area of the figure and have a great capanew town to become key players in the system. As can be seen in the distribution of two-dimensional variables, no key factor has been placed in this area.

   (b) Target variables: These variables are placed under the northeast diagonal area of the page, these variables are actually the evolutionary results of the system and represent the possible goals in a system. By manipulating and making changes in these variables, he achieved the evolution of the program system and his goal. As can be seen in the scatterplot, none of the variables were in the area of binomial variables (Fig. 2).

3. **Dependent variable**: these variables are placed in the southeast part of the figure and they can also be called result variables. These variables have a very high impact on the system and a very low impact on the system. As can be seen in the distribution of influential variables, 7 dependent variables are located in this area: lack of attention to the proximity between public open spaces and health service centers in the whole of Andisheh planned new town; Aggregation of administrative centers under the title of office complex in Andisheh planned new town; Lack of parking in most of the uses in Andisheh planned new town; The density of new constructions next to new town squares and service centers and the lack of provision of a new alarm system in these centers;
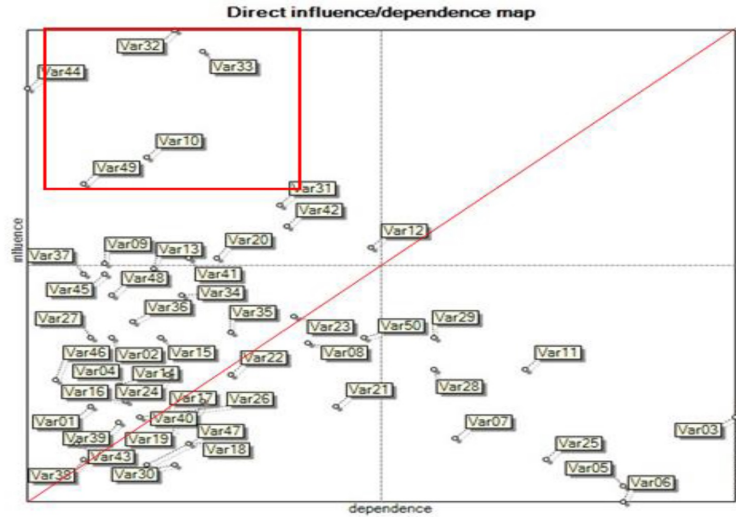
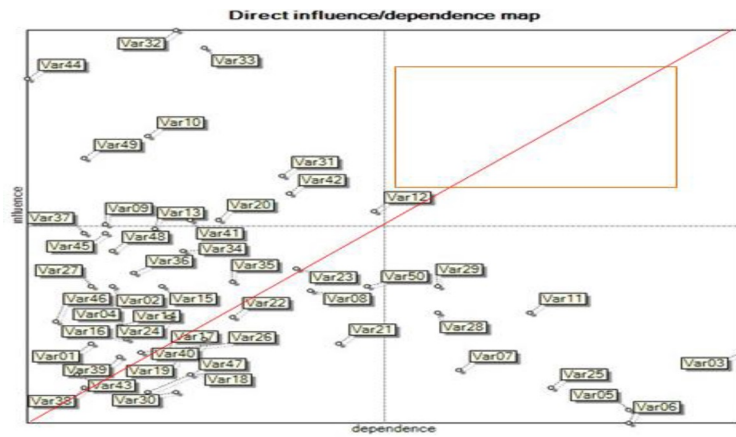Figure 1: Dispersion of affecting variables

Figure 2: Scattering of dichotomous variables

Establishment of uses and activities in the direction of the west and southwest of Andisheh planned new town, which was known as the prohibition of defense and crisis; The non-covering of the Fardis water canal and the possibility of a potential threat to the health of citizens. What can be concluded from these variables is that these variables are the result of independent variables. If independent and influential variables have a positive trend, these variables will also be positive (Fig. 3).

4. **The independent variables**: these variables have low influence and effectiveness. Of course, Andisheh planned new town is not unaffected by the severity of the crisis in other economic, social, physical, environmental and managerial dimensions. These variables were placed in the southwest part of the figure. Independent variables can be divided into two categories: system independent variables and system result independent variables.

   (a) System independent variables

   Overloading of activities in the new town center downstream of Naqsh Jahan Bazaar Andisheh planned new town; Lack of serious attention to the coordination and targeting of urban facilities and equipment towards the security and stability approach in Andisheh planned new town; The introduction of Andisheh planned new town as a dormitory new town and the possibility of threats and security reduction during the peak activity and emptying of the planned new town; The proximity of Andisheh planned new town to the capital and not considering the possibility of defending the new town in the event of cyber and military threats; Lack of attention to the development of multi-purpose spaces for possible threats; Failure to pay attention to the rules and regulations of passive defense in the detailed plan of Andisheh planned new town.

   (b) Independent variables of the system outcome

   Lack of sufficient attention to the retrofitting of urban furniture and special uses and urban infrastructure in Andisheh planned new town; lack of intelligentization of water transmission systems in Andisheh planned
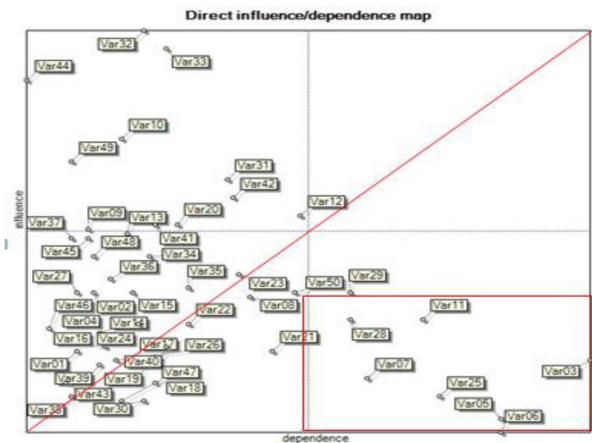
Figure 3: Distribution of dependent variables

new town; Failure to equip the new town's energy supply infrastructure with new technologies to deal with cyber threats; extensive use of absorption wells to dispose of the entire new town's wastewater; Not considering floating uses in the detailed plan of Andisheh planned new town for use in critical times; lack of vulnerability map in Andisheh planned new town; The increase in environmental pollution in most parts of Andisheh planned new town and the possibility of threatening the health of citizens; Failure to pay attention to the isolation of sensitive and vital centers due to new cyber threats; Increasing constructions under the title of residential complexes without safety and fire approval in Andisheh planned new town. (Fig. 4).
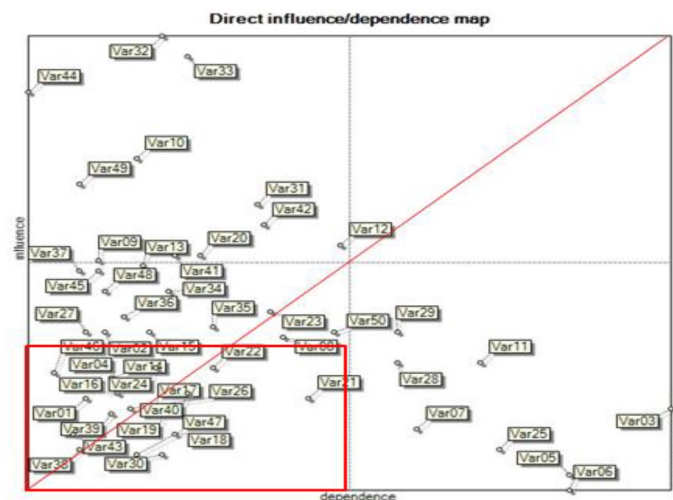

Figure 4: Distribution of independent variables

5. **Regulatory variables**: these variables are located near the center of the figure. In fact, they have a regulatory mode and sometimes act as a secondary lever. Depending on the policies that Andisheh municipality uses for its purposes. These variables have the ability to be upgraded to influencing variables, determining variables or target and risk variables. These variables are as follows.

lack of arrangement of street lighting in many parts of Andisheh planned new town; Failure to comply with defense standards and crisis management in Amir Kabir 864-residential units complex; The non-compliance and incompatibility of the proposals of the detailed plan of the new town with the existing economic and physical conditions of the new town; The development and establishment of new activities at the entrance and exit of the new town, which makes it impossible to evacuate the population in times of crisis; Failure to provide urban open spaces with flexible uses for use in times of crisis; Increasing the approvals of the change of use commission regarding the reduction of the width of the roads and the possibility of increasing the threats caused by this reduction of the width; the increase of constructions against the rules and without safety standards at the level
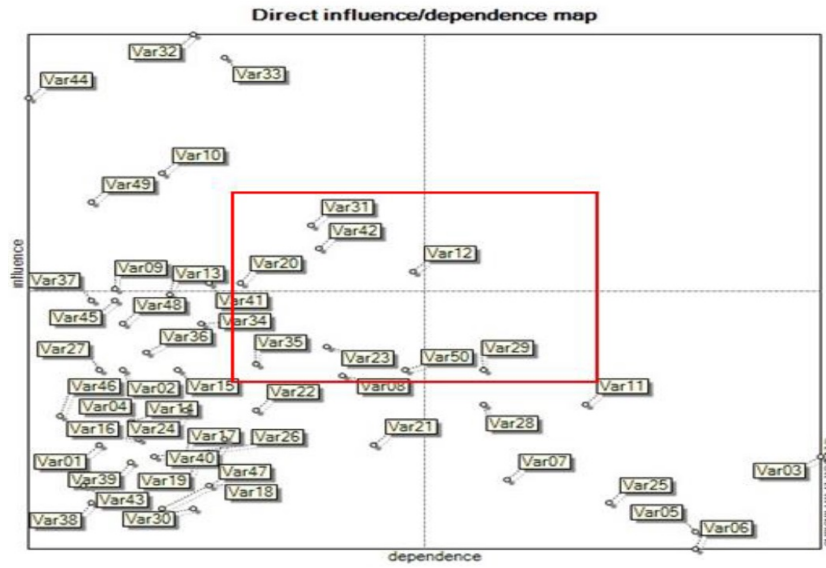
of Andisheh planned new town. (Fig. 5).

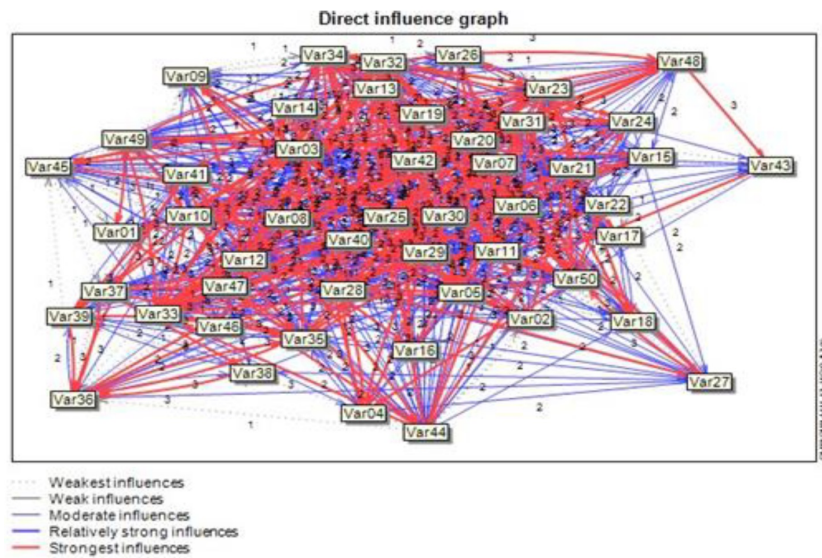Figure 5: Distribution of regulatory variables

Figure 6: Direct relationships between variables (very weak to very strong effects)

3.4 The effects and direct influence of variables on each other and their ranking

The effect of variables on each other is from zero to three and based on the opinion of experts. The amount of influence that one factor receives from other factors is recorded as influence and the amount of influence that one factor has on other factors is recorded as influencing. After the analysis of this section, the effectiveness and effectiveness of each factor was calculated and finally, in the next step, ranking was done. The ranking of the variables is given in terms of influence and direct influence, the results show that the variables of reducing the new town's reserve land with the establishment of new uses and the inability of the new town to respond to possible threats for emergency evacuation, non-compliance with the prohibitions of dangerous uses in parts of The new town, especially the high-density centers of Andisheh planned new town, the increase in immigration to Andisheh planned new town and the formation of wide ethnic diversity in this planned new town, the lack of a specific frequency on the radio of the regional officials during the crisis and the lack of a vulnerability map in Andisheh planned new town. have had a great impact on the vulnerability of Andisheh planned new town from the point of view of possible threats.
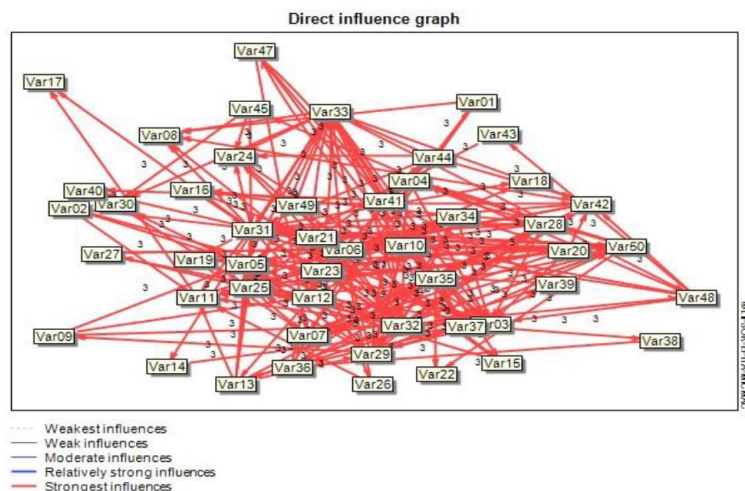
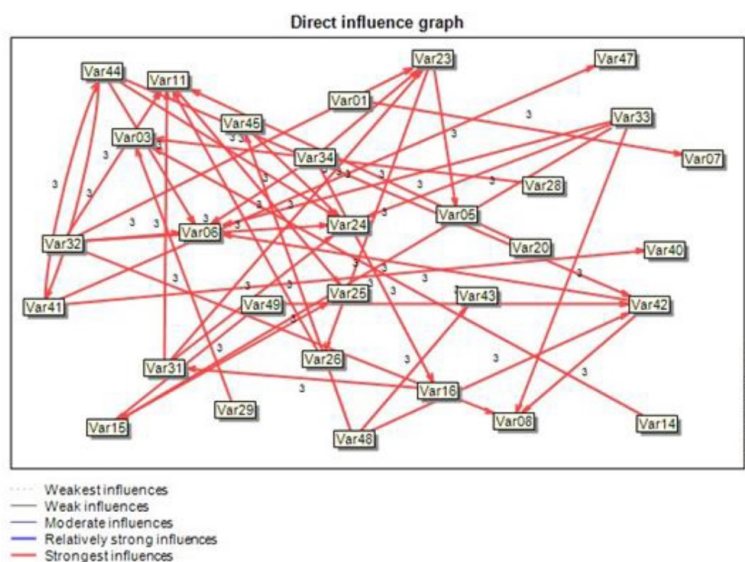Figure 7: Map of direct relationships between variables (strong)

Figure 8: Map of direct relationships between variables (very strong)

On the other hand, the variables of increasing immigration to Andisheh planned new town and the formation of wide ethnic diversity in this planned new town, non-observance of defense standards and crisis management in Amir Kabir 864-residential units complex, density of new constructions next to new town squares and service centers and The lack of provision of a new warning system in these centers and the lack of a vulnerability map in Andisheh planned new town have shown the greatest impact.

3.5 Selection of key effective factors on the vulnerability of Andisheh planned new town from the perspective of passive defense components

Among the 50 factors investigated in this research, some main factors are considered as key effective factors on the vulnerability of Andisheh planned new town from potential threats with passive defense approach. In this context, the factors of reducing the new town's reserve land with the establishment of new uses and the inability of the new town to respond to possible threats for emergency evacuation, non-compliance with the prohibitions of dangerous uses in parts of the new town, especially the high-density centers of Andisheh planned new town, the increase in immigration to Andisheh planned new town And the formation of wide ethnic diversity in this planned new town, the lack of a specific frequency on the radio of the regional officials at the time of the crisis and the lack of a vulnerability map in Andisheh planned new town has had the greatest impact on the vulnerability of Andisheh planned new town against potential threats. which requires developing defense measures in these fields.

Also, the increase in immigration to Andisheh planned new town and the formation of wide ethnic diversity in this planned new town, non-compliance with defense standards and crisis management in Amir Kabir 864-residential units complex, density of new constructions next to new town squares and service centers and lack of system provision The new notification of danger in these centers and the lack of a vulnerability map in Andisheh planned new town have been selected as the most effective key factors in the vulnerability of Andisheh planned new town (Table 3).

Table 3: key effective factors on the vulnerability of Andisheh planned new town against possible threats

Rating	Key factors (direct effect)	Influence
1	Reduction of the new town's reserve lands with the establishment of new uses and the inability of the new town to respond to possible threats for emergency evacuation.	552
2	Failure to comply with the prohibitions of hazardous uses in parts of the new town, especially the high-density centers of Andisheh planned new town	528
3	Increasing immigration to Andisheh planned new town and the formation of wide ethnic diversity in this planned new town	486
4	Lack of a specific frequency on the radio of the regional officials during the crisis	407
5	Lack of vulnerability map in Andisheh planned new town	376
6	Failure to comply with defense standards and crisis management in Amir Kabir 864- residential units complex	352
7	Lack of provision of urban open spaces with flexible uses for use in times of crisis	328
8	The development and establishment of new activities at the entrance and exit of the new town, which makes it impossible to evacuate the population in times of crisis.	303
9	Failure to consider floating uses in the detailed plan of Andisheh planned new town for use in times of crisis	291
10	Failure to provide and suggest alternative routes in densely populated parts of the new town for emergency evacuation	291
11	Absence of underground tunnels of urban facilities and equipment and the use of these equipment on the ground in the whole of Andisheh planned new town.	285
12	Not using the natural factors of the land to locate sensitive and important centers in Andisheh planned new town	279
13	Flooding of some squares and road networks such as Madar square	273
14	Failure to pay attention to the provision of additional exit and entry spaces, especially in residential complexes, healthcare centers in Andisheh planned new town.	273
15	Non-observance of access criteria, especially access to relief centers in the location of residential complexes	249

3.6 Scenarios for reducing the vulnerability of Andisheh planned new town against possible threats with an emphasis on effective defense measures

With complex and very heavy calculations, Wizard software provides the researcher with the possibility of extracting scenarios with strong probability, scenarios with weak probability, and scenarios with high probability of compatibility. As can be seen in Table 4, 14 scenarios with very strong compatibility of the software output. The nature of this software is such that it reduces the possible occurrence of scenarios from among millions of scenarios to several limited scenarios with strong probability and high compatibility. Some of the scenarios are relatively close, marked with close colors.

To facilitate the understanding of scenario conditions and the weight of favorable and unfavorable conditions, the status of each of the key factors is categorized into 4 situations (Table 5).

To understand the situation based on the score given to each of them from 2 to 2. Numbers were placed in their place so that the scenario page can be understood quantitatively. By putting a range of topics from desirability to crisis instead of the status, a qualitative understanding of the scenarios page was also provided, which can clearly show the status and position of the new town according to the scenario and each key factor (Table 6).

In the following, the status of each of the scenarios is given separately, as can be seen in Table 7, the status of the scenarios has been measured in relation to the maximum critical conditions and the maximum favorable conditions. The results show that the best favorable situation includes scenario 4, the percentage of favorability of scenario 4 is equal to 57, this means that if in the best scenario the vulnerability of the new town is reduced in the studied components, it is still less than the ideal condition (100 percentage) there is a big gap. The degree of desirability of other scenarios was less than 57% and it shows that it will be better to reach a sustainable new town. On the other hand, the maximum percentage of critical conditions is equal to 73% related to scenario 10, which means that if scenario 10 is realized, Andisheh planned new town will not be far from the worst conditions. In such conditions, the new town develops without rules and regulations or against the rules and regulations. At the same time, there is no control over the new town's receptivity to immigration, and finally, defense measures, i.e. new intelligent systems to deal with the offensive and cyber attacks of the enemy on the new town's facilities and equipment will not take.

Table 4: Scenarios for reducing the vulnerability of Andisheh planned new town against possible natural and human threats

Scenario No. 1	Scenario No. 2	Scenario No. 4	Scenario No. 3	Scenario No. 6	Scenario No. 5	Scenario No. 9	Scenario No. 10	Scenario No. 8	Scenario No. 7
Optimum use of urban reserve land according to the needs of the city				Continuation of the use process without reserve land plan		Increasing the use of urban reserve lands to respond to the needs of citizens			
Obeying the prohibitions of dangerous uses				Increasing compliance with the privacy of dangerous users	Reducing the privacy of dangerous users		Increasing compliance with the privacy of dangerous users		Reducing the privacy of dangerous users
The migration process to Andisheh planned city				Lack of necessary measures to control immigration to Andisheh planned city					
Creating a specific frequency on the officials' wireless				The continuation of the process of missing a certain frequency on the officials' wireless					
The necessary action of the devices to prepare the vulnerability map	Adding new layers to the map		Preparation of vulnerability map in Andisheh planned city	Continuing the process of not having a vulnerability map in Andisheh planned city					
Compliance with defense standards and crisis management				Continuing the trend of non-compliance with defense standards and crisis management					
Providing urban open space with flexible uses				Continuing the trend of not providing urban open space with flexible uses					
Development and establishment of new activities according to the needs of planned city				Failure to pay attention to the rules for the establishment of activities				Continuing the current trend of increasing the development and establishment of new activities at the entrance and exit of the city	
Emphasis on the development of floating applications				Continuing the trend of not emphasizing on the development of floating applications					
Providing alternative routes for possible crises				Continuing the trend of lack of alternative routes for possible crises due to population growth					
Creating underground tunnels for facilities and equipment				Continuing the current process of creating facilities and equipment in Andisheh planned city					
Using the natural factors of the earth to locate sensitive centers				Continuing the trend of not using the natural factors of the earth to locate sensitive centers					
Existence of good urban management		Urban development unit management		The lack of management of the urban development unit and the formation of issues such as flooding of roads and squares					
Provision of additional exit and entry spaces for use in critical situations				Continuing the process of not being able to create additional inputs and outputs		Failure to create additional entrances and exits in most constructions and urban facilities and equipment			
Adhering to access regulations				Failure to comply with access rules					

Table 5: Definition of the concept of numbers and situations on the scenario page

Feature	Score	Condition
The rule of the best possible situation to reduce the vulnerability of the new town	2	Optimal
Desirable trends for the implementation of executive policies and defense measures to reduce the vulnerability of planned cities in critical situations	1	The desired process
Continued problems in the planned new town and the increasing threat of this new town	−1	Critical process (status quo)
Aggravation of problems and weakening of planned new town against offensive actions of the enemy	−2	Critical

3.7 Classification of scenarios

In this section, the 10 compatible output scenarios of the wizard software were divided into three groups according to their characteristics, these groups are close to each other despite the slight differences in several variables. scenarios with favorable trends (scenarios 1, 2, 3; 4); scenarios with unfavorable and critical trends (5, 6, 7, 9); Critical scenarios (8, 10) (Table 8).

Table 6: Definition of the concept of numbers and situations on the scenario page

Factor	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9	Scenario 10
Reduction of the new town's reserve lands with the establishment of new uses and the inability of the new town to respond to threats	1	1	1	1	−1	−1	−2	−2	−2	−2
Complying with the prohibitions of hazardous uses by developing the necessary rules and regulations	1	1	1	1	1	−2	1	−2	1	−2
Immigration control to Andisheh planned new town	1	1	1	1	1	−2	1	−2	1	−2
Creating a specific frequency on the wireless of the regional authorities	1	1	1	1	−1	−1	−1	−1	−1	−1
Preparation of vulnerability map of Andisheh planned new town to create defense bases equipped with smart system	1	1	1	1	−1	−1	−1	−1	−1	−1
Adhering to defense standards and crisis management and becoming a department	1	2	1	2	−1	−1	−1	−1	−1	−1
Provision of urban open spaces with flexible uses in detailed plan	1	1	1	1	−1	−1	−1	−1	−1	−1
Lack of development and establishment of new activities at the entrance and exit of the new town	1	1	1	1	−2	−2	−1	−1	−2	−2
Considering floating uses	1	1	1	1	−1	−1	−1	−1	−1	−1
Providing and proposing alternative routes for densely populated centers	1	1	1	1	−1	−1	−1	−1	−1	−1
Creating underground tunnels for urban facilities and equipment and equipping them with smart systems	1	1	1	1	−2	−2	−2	−2	−2	−2
Using the natural factors of the earth to locate sensitive centers equipped with smart systems	1	1	1	1	−1	−1	−1	−1	−1	−1
Good urban management and governance in planned new town	1	1	2	2	−1	−1	−1	−1	−1	−1
Paying attention to the provision of additional exit and entrance spaces, especially in residential complexes	1	1	1	1	−1	−1	−2	−2	−2	−2
Adhering to access rules, especially access to aid centers	1	1	1	1	−2	−2	−2	−2	−2	−2

Table 7: Coefficients, number and percentage of each situation separately for each scenario based on the 4 spectrum of desirability to crisis

Scenario	Number of statuses separately				Status coefficients				Desirability status			Critical situation		
	Desirability	The trend of desirability	Critical process	Crisis	2	1	−1	−2	The degree of desirability	Ideal score	Percentage of desirability	The amount of critical conditions	Maximum critical conditions	The percentage of critical conditions
1S	0	15	0	0	0	15	0	0	15	30	50	0	−30	0
2S	1	14	0	0	2	14	0	0	16	30	54	0	−30	0
3S	1	14	0	0	2	14	0	0	16	30	54	0	−30	0
4S	2	13	0	0	4	13	0	0	17	30	57	0	−30	0
5S	0	2	10	3	0	2	−10	−6	2	30	7	−16	−30	−54
6S	0	0	10	5	0	0	−10	−10	0	30	0	−20	−30	−67
7S	2	0	9	4	0	−2	−9	−8	2	30	7	−17	−30	−57
8S	0	0	9	6	0	0	−9	−21	0	30	0	−12	−30	−70
9S	0	0	10	5	0	0	−10	−10	0	30	0	−20	−30	−67
10S	0	0	8	7	0	0	−8	−14	0	30	0	−22	−30	−73

3.8 Identifying critical key factors of Andisheh planned new town in scenarios

In this research, 15 key factors were extracted from 50 variables by expert opinions and through MIC MAC software. Then, the different status of each of the key factors and their impact on each other were measured by the expert group, and based on the scenario wizard software, 10 consistent and believable scenarios were obtained. As seen in Fig. 9. Out of the total of 10 key factors, the average of 4 factors was positive and 6 factors had a negative average. In general, 40% of the factors were positive in all 10 scenarios. 60% of the factors were also negative. Reducing the new town's

Table 8: Classification of scenarios

Scenarios	Total impact score	Scenario score	Mean	Conditions
1S	376	15	1	
2S	397	16	1.07	The desired process
3S	396	16	1.07	
4S	417	17	1.13	
5S	412	−8	−6.06	
6S	432	−19	−1.35	Critical process
7S	429	−15	−1	
9S	434	−16	−1.07	
8S	434	−12	−1.4	Critical
10S	454	−22	−1.5	

reserve land by establishing new uses and the inability of the new town to respond to potential threats, complying with the prohibitions of dangerous uses by formulating the necessary rules and regulations, controlling migration to Andisheh planned new town and creating a specific frequency on the radio of the regional officials, the most positive points in the possible future scenarios, which promise many and positive changes in the control of offensive and cyber enemy threats in the new town's public and service spaces as well as the new town's facilities and equipment, optimal land management and provision of spaces required for a planned new town in accordance with residential needs.

The most critical key factor includes three factors: the lack of underground tunnels for urban facilities and equipment and equipping with smart systems, lack of attention to providing additional exit and entry spaces, especially in residential complexes, and non-observance of access criteria, especially access to centers. Relief in Andisheh planned new town is with an average of -0.66 in the vulnerability scenarios of Andisheh planned new town. The next key factor is the management of the urban development unit with an average of -0.60 and it shows that the presence and absence of integrated urban management has a great impact on the performance of new town management in reducing possible natural and human damage in the new town.
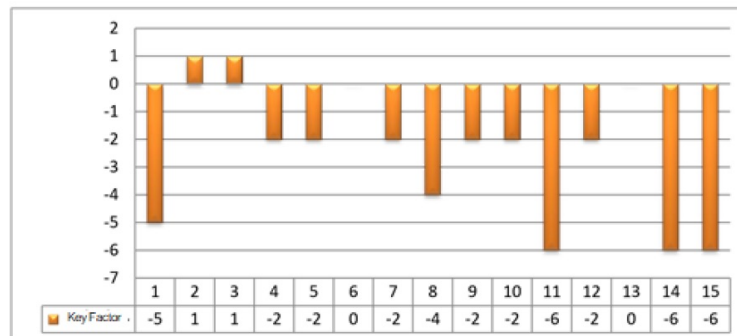

Figure 9: The level of optimal and critical condition of key factors

Finally, among the 10 scenarios selected by the Scenario Wizard software, 4 scenarios were selected as probable scenarios for reducing the vulnerability of Andisheh planned new town. The critical process was chosen, with the realization of each of the scenarios, the vulnerability of the new town will change.

1. **The strongest scenario**
   Scenario 4 is the best and strongest scenario to reduce the vulnerability of Andisheh planned new town, with the realization of this scenario, 54% of the goals of reducing the vulnerability and stability of the new town against natural and human threats will be achieved. This scenario has a lot of emphasis on the improvement of the studied components and indicators in a short schedule. Out of 15 key factors in this scenario, 2 key factors were desirable and 13 other key factors had a favorable trend and none of the factors were in a critical or critical trend state. In the scenarios, all the key factors have a positive trend and with the passage of time, they create positive changes in reducing the vulnerability of the new town.

2. **Optimal trend scenarios**
   Scenario 2 and 3 are the most favorable possible scenarios among the 10 scenarios. With the realization of these scenarios, the vulnerability reduction of Andisheh planned new town will reach 54%. In scenario 2 and 3, emphasis on action in the form of short-term programs to solve issues such as compliance with the prohibitions of dangerous centers in the development and establishment of activities, control of the immigration process to

Andisheh planned new town, timely preparation of the vulnerability map of the new town along with additional layers to it has become smart maps. What is clear is that if the 15 goals listed in scenarios 2 and 3 are fulfilled, it is likely that a large part of the shortcomings in the urban development, urban services, urban equipment and facilities, and the smartening of urban spaces will be solved.

3. **The strongest critical scenario**

Scenario 10 will be the most critical among the 10 possible scenarios, although the critical scenarios are relatively close and differ in several key factors. With the realization of this scenario and reaching the vulnerability of Andisheh planned new town will reach 73% of the worst case, out of 15 key factors, 8 key factors have had a critical trend and 7 key factors will be in critical conditions, this scenario has no positive points and most of the factors The key was either the continuation of the past trend or this trend was increasing (Table 9).

Table 9: The strongest possible critical scenarios of vulnerability and threats of Andisheh planned new town

Key factors	Optimal trend scenarios
Decreasing the new town's reserve land with the establishment of new uses and the inability of the new town to respond to threats	Increasing the use of urban reserve lands
Complying with the prohibitions of dangerous uses by developing the necessary rules and regulations	Non-observance of prohibitions of hazardous uses due to issues such as lack of land
Immigration control to Andisheh planned new town	Continuing the growth trend of immigration to Andisheh planned new town
Creating a specific frequency on the wireless of the regional officials	The impossibility of creating a specific frequency on the officials' wireless due to the lack of infrastructure and intelligent control equipment
Preparation of vulnerability map in Andisheh planned new town to create	The continuation of the past trend and the absence of a vulnerability map of the new town
Defense bases equipped with new intelligent systems	
Adhering to defense standards and crisis management and becoming a department	Continuing the existing process and not complying with defense standards
Providing urban open spaces with flexible uses in detailed plan	Continuation of the existing trend and the impossibility of providing urban open spaces
Lack of development and establishment of new activities at the entrance and exit of the new town	Increasing the establishment of new activities at the entrance and exit of the new town
Considering floating applications	The continuation of the past trend and the impossibility of considering floating applications
Providing and proposing alternative routes for high-density centers	The continuation of the past process and the impossibility of providing and proposing alternative routes
Creating underground tunnels for urban facilities and equipment and equipping them with smart systems	Continuing the existing process and creating urban facilities and facilities on the ground level
Using the natural factors of the earth to locate sensitive centers equipped with intelligent systems	Continuing the past trend and not paying attention to natural factors in the location of sensitive centers
Good urban management and governance in planned new town	Lack of urban development unit management
Paying attention to the provision of extra entrance and exit spaces, especially in residential complexes	The impossibility of providing additional exit and entry spaces
Adhering to access rules, especially access to aid centers	Failure to comply with access rules, especially access to aid centers

4 Conclusion

Crisis management and reducing the vulnerability of cities is one of the important management and development approaches of any new town. In this field, various factors and indicators are effective. According to the geographical location and position of each new town, these factors and also effective strategies in reducing the vulnerability of cities are also different. Andisheh planned new town in Tehran province, as a new town with a new structure and process, is not exempt from this issue. Therefore, knowing the effective factors in reducing the vulnerability of this new town and formulating a scenario in dealing with natural and human threats are important issues that can be investigated.

The results of this research showed that various factors are effective in reducing the vulnerability of Andisheh planned new town. The analysis shows that several factors play a role as key effective factors on the vulnerability of Andisheh planned new town in terms of possible threats with passive defense approach. In this context, the factors of reducing the reserve land of the new town with the establishment of new uses and the inability of the new town to respond to possible threats for emergency evacuation, non-compliance with the prohibitions of dangerous uses in parts of the new town, especially the densely populated centers of Andisheh planned new town, the increase in immigration to Andisheh planned new town And the formation of wide ethnic diversity in this planned new town, the lack of a specific frequency on the radio of the regional authorities at the time of the crisis and the lack of a vulnerability

map in Andisheh planned new town has had the greatest impact on the vulnerability of Andisheh planned new town against potential threats. which requires the formulation of defense measures in these fields. Also, the increase in immigration to Andisheh planned new town and the formation of wide ethnic diversity in this planned new town, non-compliance with defense standards and crisis management in Amir Kabir 864-residential units complex, density of new constructions Along with the squares and service centers, the lack of modern warning system in these centers and the lack of vulnerability map of Andisheh planned new town are known as the most effective key factors in the vulnerability of Andisheh planned new town. The result of this part of the research with Mohamed and El-Raey [11], Song et al. [18], Tapia et al. [19], Rezaei and Yarahmadi [13], Baghbani et al. [2] and Razpour et al [12] overlap; Because in this research, the control of the social, economic and physical conditions of cities is emphasized in order to improve the state of urban vulnerability. In other words, factors such as correct location of users, respect for privacy, removal of incompatible users, preparation of zoning maps, establishment of crisis centers, improvement of access, etc., are mentioned in order to improve urban vulnerability and crisis management.

In line with Key effective factors on reducing the vulnerability of crises and natural and human threats, the results show that different scenarios can be planned for this issue. In order to reduce the vulnerability of Andisheh planned new town, 10 scenarios have been proposed, and based on the results, 4 types of scenarios include one scenario as the strongest scenario, one scenario as a favorable trend, and two scenarios as critical scenarios, as possible scenarios to reduce the vulnerability of Andisheh. planned new town were selected. With the realization of each of the scenarios, the vulnerability of the new town will change. The most powerful scenarios have a lot of emphasis on improving the indicators, including increasing the use of urban reserve lands, complying with the prohibitions of dangerous uses, and controlling the growth of immigration in a short schedule. The result of this part of the research in the field of effective scenarios to reduce vulnerability overlaps and agrees with the research of Hashemi Fesharaki et al. [6], Razpour et al. [12] and Baghbani et al. [2].

Also, in the field of favorable trend scenarios, with the realization of these scenarios, the vulnerability of Andisheh planned new town will be reduced to 54%. In this scenario, emphasis on action in the form of short-term programs to solve issues such as observing the prohibitions of dangerous centers in the development and establishment of activities, controlling the process of immigration to Andisheh planned new town, timely preparation of the vulnerability map of the new town along with its additional layers and It has become smart maps. What is clear is that if the goals in this scenario are achieved, it is likely that a large part of the shortcomings in the urban development, urban services, urban equipment and facilities, and the smartening of urban spaces will be solved. Another scenario is the critical scenario. Critical scenarios are relatively close and differ in several key factors. With the realization of this scenario and reaching the vulnerability of Andisheh planned new town, it will reach 73% of the worst case. This scenario does not have positive points and most of the key factors have been either the continuation of the past trend or this trend has been increasing.

In general, the results confirm that various factors play a role in reducing the vulnerability of Andisheh planned new town and improving its passive defense. to help Andisheh planned new town needs to reconsider the decision-making and implementation approaches in part of the economic, social and infrastructural-physical factors. This process can be done in a format of three short-term, medium-term and long-term programs. According to the results and conclusions of the research, some suggestions or solutions are provided.

1. Preparation of the vulnerability map of Andisheh planned new town 2. Pay attention to the rules and regulations of passive defense in the detailed plan of Andisheh planned new town. 3. Observance of safety principles, including the establishment of shelters in vital and sensitive centers. 4. Considering defense measures such as smartening public spaces for Timely identification and support 5. Paying attention and equipping centers with new technologies under the title of new town management relief centers in times of crisis in order to create integrated management of executive bodies in Andisheh planned new town 6. Smartening of water transmission systems in Andisheh planned new town and also equipping The new town's energy supply infrastructure with modern technologies to deal with cyber threats 7. Establishment of underground tunnels for urban facilities and equipment in the whole of Andisheh planned new town 8. The optimal distance of energy transmission networks in the whole level of Andisheh planned new town 9. Using the natural factors of the earth to locate sensitive and important centers in Andisheh planned new town 10. To create service centers according to the capanew town and potential of the new town, such as service markets with single function activity in the whole of Andisheh planned new town.

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