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The role of advanced crisis management in providing relief during an earthquake using the location of vulnerable areas based on the risk matrix (case study: Lahijan city)

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Abstract

In general, crisis management means purposefully pushing the progress of affairs to a controllable routine and expecting things to return to the pre-crisis conditions as soon as possible. In short, crisis management is all actions related to prevention and risk management, organization and management of resources needed in response to crisis. Crisis management is an applied science that, through systematic observation of crises and their analysis, seeks to find tools that can be used to prevent the occurrence of crises or, in case of occurrence, in terms of reducing the effects of the crisis, necessary preparation and rapid relief. and took action to improve the situation. The main purpose of this research is modern crisis management in the probability of an earthquake based on risk matrix by locating vulnerable areas in Lahijan city using AHP, TOPSIS and SWOT analysis. (DOI:**https//doi.org/10.52547/JCER.4.4.33**)

"Keywords: Crisis management, Feasibility study, AHP hierarchical analysis."

1. Introduction

Today's life continues while the shadowing of uncertainty on all matters has completely transformed the decision-making process for various reasons. Technical changes along with other environmental changes of organizations have caused the emergence of new scientific ideas in the field of risk and its management. In management decisions, there is no topic more necessary and important than risk assessment and crisis management. Engineers, contractors and designers in the implementation of construction projects usually try to create a suitable combination between risk and return, so that they can minimize the risk by planning and managing it. In fact, it is not about finding an acceptable investment solution, but rather determining a suitable situation for crisis management. In fact, risk is an integral part

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of people's and organizations' lives, and all decision-making situations face a variety of risks. Taking risk is not bad in itself, the important thing is not to be exposed to risk for no reason. Human life is intertwined with the acceptance of risk in such a way that perhaps the absolute lack of risk-taking causes human life to be placed in a lower order than the current level. Also, the traditional attitude towards advanced crisis management was to believe that crisis management means putting out the fire; This means that crisis managers sit waiting for things to break down and after the destruction occurs, they try to limit the damage caused by the breakdowns. But recently, the attitude towards this word has changed. Based on the latter meaning, a set of practical plans and plans should always be prepared to face possible future developments within organizations, and managers should think about possible future events and prepare to face unforeseen events; Therefore, crisis management emphasizes the necessity of regular forecasting and getting ready to face those internal and external issues that seriously threaten the reputation, profitability, or life of the organization. It should be noted that crisis management is different from public relations management. The public relations manager tries to make the organization look good while the crisis manager tries to keep the organization in a good position in difficult situations. Crisis management as a scientific discipline is generally placed in the field of strategic management and is specifically related to strategic control topics. Urban communities need to maintain security, psychological comfort, lack of disturbance and structural disorder, and in terms of the psychology of urban environments, they demand optimal organization in order to achieve the goals and strategies of the city, against any danger. Also, evaluating the course of evolution and how the management practices of the city have changed during different historical periods can determine the relativity of the city's approach in understanding the events that may occur in the future as accurately as possible.

2. Method of Study

This research is one of the quantitative researches and in terms of its purpose, it is one of the exploratory researches, because it seeks the role of advanced crisis management in providing relief during an earthquake by using the location of vulnerable areas based on the risk matrix (case study: Lahijan city). Also, due to the fact that the information of the investigated community was collected using interviews, this research is a survey research and in terms of the type of study, it is a case study.

The method of this research is analytical and descriptive and the comparative method will be used to summarize the findings and determine the vulnerable points. The tools of this research will include documentation and library resources and the preparation of a researcher-made questionnaire. This research will first examine the degree of vulnerability of the studied area during an earthquake, and by collecting the questionnaire and determining the criteria affecting the degree of damage using the series method. AHP levels are taken into consideration and location of vulnerable points using SWOT analysis technique will determine weaknesses and strengths, opportunities and threats and strategies, policies or measures will be presented to reduce its vulnerability and advance aid delivery.

3. Analysis Proseccos

In this research, the weighting model of the multi-criteria method has been used, in which the factors that are effective in determining the location are determined first.

In the next step, these indicators are quantified. In the third stage, points are given to these factors based on their quantity. In the fourth step, in order to obtain the total score of each area, instead of adding up the scores of each factor, one can assign a weight to each of them, and then calculate the weighted sum of the total score.

In other words, after determining the effective factors:

- Each factor is assigned a weight.

• The degree of location selection is known for each factor.

• The weight distribution of the factors is calculated among the resulting accumulation.

• Weighted density is obtained for each area.

• The place or places that have the maximum weight are chosen as the right place.

Also, based on the primary and secondary data, first the spatial data digitized from the existing maps in the storage and maintenance system, then the required non-spatial (descriptive) data is attributed to each condition. In this way, by using the stored spatial database and non-spatial database, the geographic information system is produced and the possibility of retrieving, deleting and adding, classifying and analyzing data using factors that are effective in choosing a place is provided. becomes The result of the analysis is the production of a map in which suitable areas are specified.

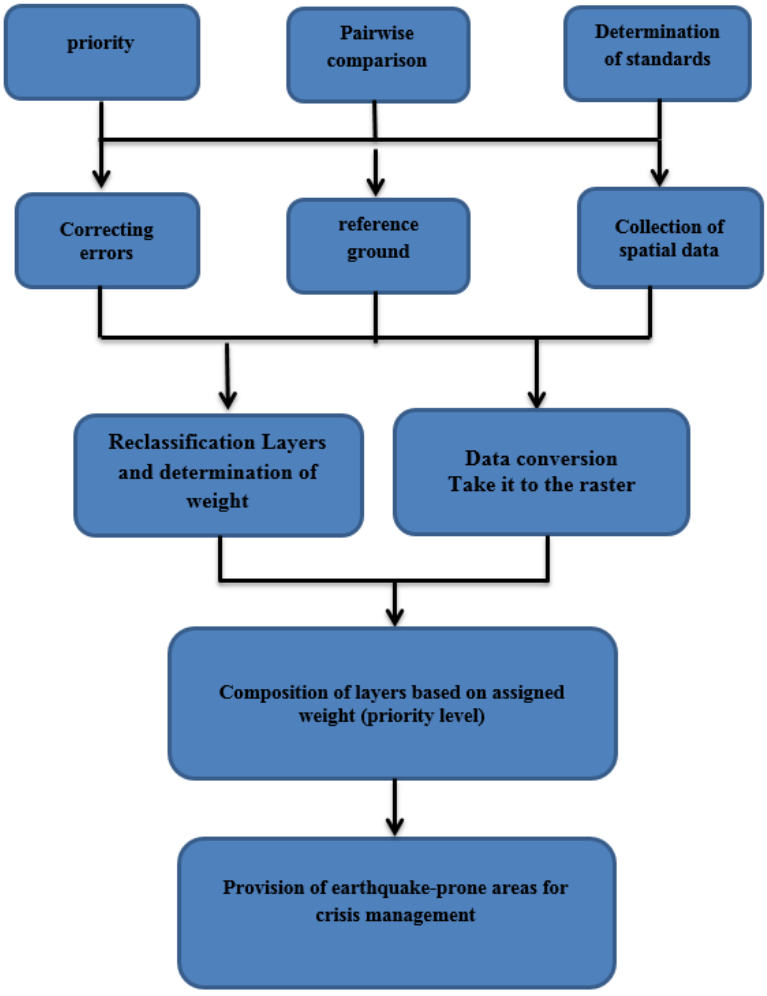

Figure-1- Schematic design of positioning model

4. Data Analysis:

In the multi-factor evaluation, different physical factors and economic and social conditions of the region are used to determine the intended use. Land suitability for a specific type of use can be determined by evaluating multi-factor techniques. Suitability of use for a specific use depends on the characteristics of that place and its topological relationship with its environmental factors. The most important characteristic of the multi-factor evaluation method is the method of combining and analyzing information, considering that in the multi-factor evaluation, different parameters are analyzed, so this increases the complexity of the evaluation process.

Based on this, geographic information is increasingly used by specialists in the identification of terrestrial phenomena and the analysis of the obtained information.

The geographic information system can be considered as that part of database management that provides both technology and software for obtaining, storing and retrieving, processing and displaying spatial information. The geographic information system widely displays available information on two-dimensional maps and focuses on equipment and facilities to integrate and analyze information.

The geographic information system provides tools to support spatial information to evaluate multiple factors in order to reach a logical and justifiable decision.

The use of multi-agent techniques in the geographic information system is based on a logical method that provides the necessary tools for analysis and planning.

Using the multi-factor evaluation method requires operations, the most important of which are:

1- Identification of effective factors in evaluation

2- Standardizing the values in the maps of the evaluated factors

3- Determining the coefficients of effective factors in evaluation

4- Method of analysis of effective factors in evaluation.

Standardizing data means equalizing the range of data change between zero and one [1 and 0]. Effective factors in evaluation usually have a different nature from each other and their measurement criteria are different from each other.

In order to effectively use all the factors in the analysis and establish a relationship between them, the existing values are normalized to each of the effective factors in the evaluation under a special rule, which is called data standardization.

For this purpose, methods similar to those used in satellite data processing to increase the contrast between classes and improve the quality of information are used. AHP, TOPSIS and SWOT methods were used in this research.

5. Hierarchical AHP analysis

Hierarchical analysis process is one of the most comprehensive systems designed for decision making with multiple criteria. At the same time, this technique provides the possibility of formulating the problem hierarchically, creating a combination of different quantitative and qualitative criteria [1].

AHP is a mathematical method for analyzing complex problems with multiple criteria. This method was first presented by Thomas L. Saaty. This process begins with the identification and prioritization of decision making elements. These elements include goals, criteria, characteristics and possible options that are used in prioritization [2].

In this method, after creating a tree or hierarchical structure of decision-making elements (objectives, criteria and options), a two-by-two comparison of each level of elements is made, thus determining the weight of each element in a cluster or level and in order to ensure the stability of the determined weights to achieve the desired goal, calculate their compatibility rate.

Hierarchical analysis is a process that can easily reflect the change of environmental factors and obtain appropriate results. This process helps the members to identify the variables that are subject to drastic changes and also facilitates the calculation of these changes [1].

Analysis is very compatible with the way of thinking and mental processes of humans and can

Table-1- 9 hourly quantitative scale for binary comparison of options

explain	**Definition**	**Score (severity of importance)**
In achieving the goal, two criteria are equally important	Equal importance	1
.Experience shows that i is slightly more important than j to achieve the goal	A little more important	3
.To achieve the goal, i is more important than j	more important	5
.To achieve the goal, i is much more important than j	Much more important	7
.The much greater importance of i than j has been definitely proven	Absolute importance	9
When there is an intermediate state		

Table-2- The matrix of the main research criteria

Socio-economic conditions	Features of the shape of the earth	Weather and climate conditions	Criteria
1/5	3	1	Weather and climate conditions
1/5	1		Features of the shape of the earth
1			Socio-economic conditions

take advantage of people's verbal opinions and judgments during decision-making and make decisions individually and in groups [3]. In the hierarchical analysis model as a decision-making model, one of the main sources of analysis data is the opinion of the decision-makers themselves [4].

Up to this stage, the importance coefficients of criteria and sub-criteria and options have been determined in relation to the purpose of the study. At this stage, the "final score" of each sub-criteria will be determined by combining the importance coefficients. For this purpose, the hourly "Principle of Hierarchical Composition" will be used, which leads to a "Preference Vector" considering all judgments at all hierarchical levels. According to the analysis done by Expert Choice software, the relative weight of each risk is calculated according to the probability of an earthquake.

The "final score" of each option is determined by combining the importance coefficients of the criteria in relation to the purpose of the study, as well as the importance coefficients (score) of the options in relation to each of the sub-criteria. The method of determining the final score of options is based on the hourly "principle of hierarchical composition" and using importance coefficients that lead to a "priority vector" considering all judgments at all hierarchical levels:

$\sum_{k=1}^{n}\sum_{i=1}^{m} W_k W_i(g_{ij})$ = final score (priority) of option j

where in:

W_k= importance coefficient of criterion k

W_i= importance coefficient under criterion i

g_{ij}= score of option j in relation to sub-criterion i

Offensive strategies (S-O): are strategies that seek to take advantage of opportunities and are well coordinated with the organization's capabilities.

Protection strategy (W-O): overcoming weaknesses in order to take advantage of opportunities.

Competitive strategy (S-T): Identifying methods that the organization can use to reduce its vulnerability from threats.

Defensive strategy (W-T): a completely defensive strategy that prevents the organization from being harmed due to its weaknesses from threats from the external environment.

6. QSPM matrix analysis

In this study, also from the quantitative strategic planning approach (Quantitative Strategic Planning Matrix). It was used to prioritize strategies. The QSPM quantitative strategic planning matrix is also an analytical method that provides managers with the

possibility of evaluating alternative strategies based on internal and external influencing factors.

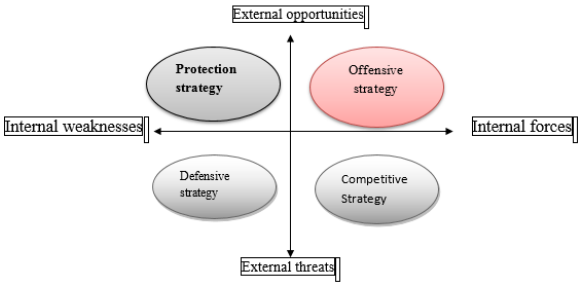

Figure-3- The strategic situation of earthquake feasibility in Lahijan city and crisis management in this city

With this method, various strategies were determined objectively, which are among the best strategies. Management strategies in this research were obtained by using different tools and in three general stages including information entry, their comparison and decision making stage (Figure 3).

In the input phase, the main information needed for the formulation of strategies was determined. After that, internal factors evaluation matrix (IFE) and external factors evaluation matrix (EFE) were implemented.

The information obtained from this stage provides a basis for comparison (third stage) and by considering them, different strategy options can be identified and evaluated in order to choose the best strategies. By determining the cumulative effects of each of the internal and external factors, the relative attractiveness of each of the strategies can be determined.

In order to provide a quantitative strategic evaluation matrix, six steps were followed as follows:

1- Major external opportunities and threats and major internal strengths and weaknesses were reflected in the strategic planning matrix. This information is obtained directly from the evaluation matrix of internal and external factors. At least 13 very important external factors and 12 very important internal factors were paid attention to in setting up the QSPM matrix.

2- A weight or coefficient was given to each of the internal and external factors. These coefficients are just like the coefficients of the evaluation matrix of internal and external factors;

3- The compiled strategies were written in the top row of the matrix;

4- Then the attractiveness scores were determined. The attractiveness score shows the power and ability of the strategy in dealing with internal and external factors (taking advantage of strengths and opportunities and eliminating weaknesses and avoiding threats), which was entered as follows: 1 = no attractiveness, 2 = up to somewhat attractive, 3 = reasonably attractive and

4 = very attractive;

5- The attractiveness score of each strategy is calculated from the sum of the product of the importance coefficients in the attractiveness scores. The sum of the attractiveness scores indicates the relative attractiveness of each strategy, which is obtained only by considering the effect of the relevant internal and external factors.

The higher the sum of attractiveness scores, the more priority the discussed strategy will have.

High scores indicate a higher attractiveness of the strategy

7. Discussion:

Cities have a physical space, each of these bodies contains an activity, and all of them make the city space and give it an identity. Cities are defined by human concentration centers, human activities and buildings.

The urban space contains infrastructure facilities and equipment with all kinds of uses, including residential, office, service, health, etc. The above categories will lead to a dependent population, which is greatly affected by the occurrence of natural disasters and causes unrest in the life system and many human and financial losses in the cities.

The occurrence of unexpected events in the history of human life has always had a limiting and effective role and has left many effects; Therefore, how to deal with these crises is one of the constant anxieties of human societies. The methods of dealing with these crises can intensify and mitigate its negative effects. The feasibility planning process of seismic areas is very important; If this process is not

logical and calculated, the probability of the produced programs being valuable will be low.

Preparation of crisis management plans is considered a basic step in crisis containment, but these plans will have the necessary efficiency when they are regular and up-to-date, as well as their effectiveness, especially those parts that are related to the reaction and response phase in a crisis. are related, there is sufficient assurance.

The geography of Gilan province with favorable natural and artificial opportunities is prone to improve crisis management and select suitable areas for settlement.

But these opportunities require a will to overcome challenges and bring these opportunities to their destination in an action plan. Also, scientific manipulation and intervention by preserving the originality of nature can lead to consolidation of crisis management foundations in the province, especially in Lahijan city.

Feasibility or feasibility studies is the assessment and analysis of the potential of a proposed project and is based on research and studies that support the decision-making process.

Feasibility discusses whether things are possible. Feasibility studies are carried out after the stage of creation of the plan and definition of its general framework in terms of the general characteristics of the product, production capacity and investment amount. These studies can be included in different levels of project details according to the needs and requests of the employer.

In fact, the feasibility study in this study was conducted on the earthquake-prone areas of Lahijan city in order to prevent casualties and financial and life losses in sensitive areas.

8. Conclusion:

Proper location is always the first and most important step in the crisis management process. In this regard, one should try to choose suitable areas based on the limitations and capabilities required by the plan. It should be noted that the studies required for location are very extensive and by using satellite images and geographic information system, an important part of these studies can be done without physical presence in the region. The land and the shape of the land is the stage on which structures play a role. Lowlands and elevations, drainage patterns, geology and soil are some of the factors related to the shape of the land.

Designers, aviators, and astronauts see the same mountains, valleys, plateaus, and lowlands, but relief workers and crisis management consultants, who deal with details rather than pictures, have very different perspectives; Therefore, in the operation that takes place in the tactical category, natural complications should be well known. In the area that is chosen for crisis management and loss prevention, issues such as: the type of rocks, the resistance of the rocks, the slope of the slope, the location of the area in terms of natural hazards such as; Earthquakes, floods, falls, landslides, the effect of wind on the ground, heights overlooking the area, erosive activities of precipitation and temperature, the amount of soil moisture, etc. must be considered.

It is obvious that any kind of management can be done if, at the time of Talah, one acts to identify and examine the shapes and complications of the ground surface and study them accurately, and the battlefield recognizes the position of oneself and the enemy by knowing the shapes of the ground. and took the necessary measures.

In order to identify earthquake-prone places in Lahijan city, variables such as: temperature, freezing days, drought, distance from the fault, slope direction, degree of slope, distance from water sources, distance from power plants, access to suitable roads, distance from Airport, distance from railways, distance from urban and rural areas, access to healthcare services, distance from commercial and industrial complexes and gas fields, distance from pipelines, compliance with distance from air corridors, distance from ports were investigated. The results showed:

1- According to AHP analysis, the criterion of socio-economic conditions with a weight of 0.53 was the most important criterion selected according to experts.

2- According to the results of the TOPSIS analysis, the distance from urban and rural areas (0.930) is the most related to the sub-criterion.

3- According to the analysis, region 2 has been selected as the most seismic place for crisis prevention and management with 0.684.

4- According to the SWOT analysis, the total of internal factors is greater than zero and equal to 0.423 and this indicates that the strengths are more than the weaknesses.

5- According to the SWOT analysis, the sum of external factors that is greater than zero and equal to 0.254, it can be said; Opportunities are more than threats.

6- In the selected location, 9 internal strengths against 4 internal weaknesses and 8 opportunities against 4 threats have been identified and investigated. In this way, a total of 17 strengths and opportunities were identified as advantages and 8 weaknesses and threats were identified as limitations and bottlenecks in choosing a suitable location for crisis management in Lahijan city.

7- According to the score obtained from the final sum of the matrix of internal factors, it is concluded that in the feasibility of earthquake-prone areas in Lahijan city with the current situation, the strengths for crisis management are more than its weaknesses.

8- Based on the obtained values and according to the matrix, out of the four possible strategies, the optimal strategy for crisis management in Lahijan city, SO or offensive strategies, was proposed and used.

9- The results of the Quantitative Strategic Planning Matrix (QSPM) show that among the prepared strategies, the highest attractiveness is related to the strategy of logistic support and flexibility, and the lowest attractiveness is related to the strategy of increasing utility costs (water, electricity, gas).

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