Prediction of Gully Erosion Susceptibility and Its Hazards in Kloche Bijar Watershed Using Spatial Predictive Models

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Introduction

Soil erosion by water is one of the most important processes of land degradation, especially in semi-arid regions. Among the different types of water erosion, gully erosion is one of the most important events affecting soil destruction, changing the landscape and water resources, and land regression [1]. Gully erosion is the most obvious form of soil erosion, which leads to a decrease in soil production capacity and restrictions on land use, and can be a serious danger to roads, fences, and various structures, and also causes significant soil losses and the production of large amounts of sediment [2]. This erosion is also called gully erosion. A gully is a relatively permanent waterway that temporary streams of water pass through during rainfall and carry a large amount of sediment [11]. The formation of gullies is always accompanied by erosion and changes in the appearance of the land and causes the production of a significant amount of sediment, destruction of lands, roads, irrigation networks and filling of dams [9]. Gullies, which are considered major indicators of environmental changes in most cases, are not considered normal forms of erosion due to their rapid growth [8].

In the studies conducted both inside the country and abroad, various methods have been used to evaluate the potential of gully erosion, which are mentioned below. Among the methods used to determine the potential of gully erosion are regression models [17, 10, 4, 15, 23, 22], knowledge-based model of hierarchical analysis [6, 21, 22, 3, 29], fuzzy logic. [12 and 13], Dempster-Shafer model [14], artificial neural network and support vector machine [33], etc. pointed out that, based on this, the watershed of Klocheh Bijar in Kurdistan province has been severely affected by this type of erosion and caused the loss of many agricultural lands in the studied basin have been eroded. Therefore, the gully erosion susceptibility mapping of the studied basin was studied and investigated using Logistic Regression and Fuzzy Logic models, and finally

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mapping of gully erosion in the studied area and the validity of both used models were verified.

Material and Methods
Gully erosion inventory map
In this study, 950 points at the top of gullies (head cuts) were recorded as a distribution map of gully erosion using Google Earth images and field survey. Then, they were divided into two parts of training data (70%) and validation (30 percent) were divided. The training data were used in the model learning section with the logistic regression method and the validation data were used to determine the validity/prediction power of the models.

Logistic regression model
Multiple logistic regression is a multivariate technique that considers several physical parameters that may affect the probability. In this method, the values of the independent variable can be expressed in binary form (0 and 1) and as a numerical quantity.

Fuzzy logic model
In classical set theory, an element is either a member of the set or not (zero and one). Fuzzy set theory extends this concept and introduces graded membership. So that an element can be a member of a set to some degree and not completely. In other words, a fuzzy set is a set of elements with similar characteristics, where the set has a certain degree from zero to one. Zero means no membership and one mean full membership [24]; Therefore, before implementing the fuzzy model, it is necessary to determine the membership functions for each of the layers mentioned above and set the value of the layers in a range between (zero and one) and then enter the layers into the fuzzy model. To implement the fuzzy technique, a gamma operator is needed, the value of the modulating gamma is between zero and one, zero gamma is equivalent to fuzzy multiplication and one gamma is equivalent to fuzzy addition.

Results and Discussion
Gully erosion susceptibility map
logistic regression
Table. 1 shows TOL and VIF values of factors affecting the occurrence of gully erosion. Viewing this table shows that all effective factors have a TOL value greater than 0.1 and a VIF less than 10, which indicates the absence of multiple collinearities between them, and all of them are used as input for the model. They were branched with appropriate logistic regression.

Fuzzy Logic
Figure 5 shows the prediction map of gully erosion using fuzzy logic. Although the pattern of distribution of different areas from the map obtained with the fuzzy logic model follows the logistic regression model, but it seems that an

exponential exaggeration in the area of the area with the probability of gully erosion is very high is seen, which is probably related to choose the numbers for the gamma value during modeling with this method. However, the areas with high and very high probability of occurrence correspond to the top of gullies (head cuts).

Conclusion

Gully erosion is one of the most important natural hazards and the main cause of land degradation in the Klocheh Bijar watershed in Kurdistan province. Recognizing the most important factors affecting the occurrence of this phenomenon as well as predicting areas prone to its occurrence is one of the management and preventive measures to better understand the area before any engineering/structural and biological measures (land management) or a combination of both. Reduction of possible damages. Preparing a gully erosion susceptibility map can be a useful guide for planners, managers, organizations and decision makers regarding the management of these areas. In this research, 950 points at the top of gullies (head cuts) were recorded as a distribution map of gully erosion using Google Earth images and field survey and were divided in the ratio of 70 to 30. Multilinear correlation test was used to check the internal correlation of 20 effective factors, as well as two models of logistic regression and fuzzy logic were used to prepare prediction maps of gully erosion in the study area.

Keywords: Gully erosion, Sensitivity, Logistic regression, Fuzzy logic, Model performance, Klocheh Bijar watershed.

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Comparasion groundwater extraction of the Hezar-Masjid aquifer between Iran and Turkmenistan and its hazards

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Introduction
This practical research in karst water areas is evaluating the climate change impact on water resources. In recent years, global warming and rainfall deficiencies have caused an increase in the exploitation of groundwater resources in many parts of the world, including Iran. On the other hand, water resource scarcity and atmospheric precipitation under the influence of climate change are significant in groundwater recharge. Due to the relatively high potential of karst waters and the severe water shortage problem in the country's north-eastern regions, the management of the Kope Dagh basin is essential. Changing the hydrodynamic characteristics is the prominent hydrogeological feature of this type of aquifer. In studying groundwater in limestone formations, springs are imperative and directly reflect the internal characteristics of the aquifer. The karst water resources are renewable and will be very effective in reducing the withdrawal from the alluvial aquifers in the region, and by knowing more about these resources, the issue of groundwater leakage from Iran to Turkmenistan can be prevented to some extent. In the last fifty years, the excessive withdrawal of water by Turkmenistan from the karst water basin of Hezar-Masjed and the lack of a suitable legal regime has created challenges.

Research Methods
The Monte Carlo method is a computational algorithm that uses random sampling to calculate results. Monte Carlo methods are commonly used to simulate physical, mathematical and economic systems. Monte Carlo simulation methods are instrumental in studying systems where there are many variables with two-by-two related degrees of freedom, including fluids. After all, Monte Carlo methods are also helpful for simulating highly uncertain phenomena in their inputs. For this purpose, first, the region's climate and weather observation data were reviewed and evaluated to know the changes made in terms of precipitation, temperature and evaporation in the last fifty years and obtain the

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amount of water entering the region. The data belonging to Bojnord, Esfrain, Jajerm, Maneh, Samalghan and Neishabur were analyzed to assess the synoptic and rain gauge stations. In order to check the amount of water consumption in Iran and Turkmenistan, water withdrawal data in the form of wells, aqueducts and springs were received from the Ministry of Energy. Using GIS and climate software and according to the available statistics, the necessary data was coded with the Crystal Ball add-on in Excel 2016 and simulated with the Monte Carlo method.nvestigated the amount of water withdrawal from the Hezar-Masjed karst table between Iran and Turkmenistan.

Innovation
The effect of climate change on karst aquifers of Hezar-Masjid in the Kope Dagh zone

Designing sustainable water management strategies in karst areas

Evaluation of the sensitivity of karst water sources to climate changes and karst landforms

Formulation of optimal model and selection of optimal solutions in connection with karst water management

Keywords: karst aquifer, geomorphology, hazards, Hezar-Masjid, Turkmenistan, Iran.

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Zoning and estimation of range movements in Hashtroud city using radar interferometry and MABAC model

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Introduction

Landslide is a term that includes all types of slope movements and causes mass movement of materials on slopes. This term includes all processes that lead to mass movement of materials on slopes and according to the type of movement, it can be classified as sliding, flow, or falling movements. and creep is classified. The instability of natural slopes is one of the geomorphological and geological phenomena that plays an effective role in changing the shape of the earth's surface. Recognizing areas with landslide potential and zoning them is one of the basic steps in managing environmental hazards and reducing damages caused by this phenomenon, because this phenomenon causes financial and human costs, soil and land destruction, and increased sediment production in the basin outlet. Iran, with its mainly mountainous topography, high tectonic and seismic activity, diverse geological and climatic conditions, has the main natural conditions to create a wide range of landslides. Landslides in Iran, as a natural hazard, cause a lot of human and financial losses to the country every year.

Materials and methods

Radar satellite images: In this research, Sentinel 1 images, which captures images in the C-band range of microwaves, have been used. Then the necessary processing was done through SARSCAPE 5.2 plugin in ENVI 5.3 software and the technique used in this research to determine the amount of subsidence is the differential interferometric method with combined opening of two frequent or non-frequent passes. One of the most basic steps in radar interferometric processing is the selection of the appropriate image pair, which several factors such as sensor frequency, spatial baseline, time baseline, and spatial overlap along the sensor movement are effective in selecting the image pair. In this research, two SLC type Sentinel-1-A images from 2015 and 2020 were used.

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Discussion and Results
By studying how and the possibility of displacement on the surface of the earth, it is possible to estimate the influencing parameters in the process of displacement of the earth, and it can be used in geophysical modeling and determining the necessary solutions to deal with range movements. Among all ground and space methods for measuring changes in the earth's surface, the radar interferometric technique is known as a useful tool and the best method. The amount of displacement shows the domain movements in the studied area. Positive values indicate the amount of displacement in the direction of satellite sensors and negative values indicate the amount of displacement against the direction of the sensor. The amount of movement of slope materials measured in the study area shows a maximum of 23 cm and a minimum of 18 cm in the study area in the years 2015 to 2020, the highest amount of slope movement is in the south of Hashtroud and the lowest is in the north of Hashtroud.

Conclusion
The radar interferometric method is a very accurate method that can detect domain movements using two images of the same area in different time intervals very accurately in centimeters and even millimeters. The results of field research also confirm the high accuracy of satellite images. By using this technology, it is possible to monitor small movements of the earth's surface continuously, with high accuracy and in a wide area. Radar images have identified domain movements in the studied area with very high accuracy. The results of this research showed that radar images have a good potential for revealing the instability of domains and calculating their displacement. The maximum amount of material movement is 23 cm in the studied area. The process of doing the work is based on a combination of library and field methods and using satellite images. For this purpose, first, a map of landslides in the region was prepared with field visits. Then, by reviewing and examining the sources, the factors that can be effective in the process of landslide occurrence, extracting and examining the sources, natural and human factors such as soil, slope, distance from the waterway, distance from the road, geology (lithology), precipitation, height to prepare a map Landslide risk zoning and potential were used. The resulting map was classified into 5 risk classes and evaluated according to the landslides that occurred in the studied area. According to the results of the evaluation, the used models show a suitable ability to predict the occurrence of landslides. The analysis of the results showed that the amount of precipitation and altitude play a greater role in creating high-risk areas than other factors.

Keywords: landslide, natural hazards, radar interferometry, MABAC model, Hashtroud city.

Organizational resilience of telecommunications companies against the hazards of the covid-19 pandemic

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Introduction

Today, all businesses and organizations are increasingly facing a dynamic, changing environment with high uncertainty and in order to survive and maintain themselves in this complex world, they have to constantly adapt themselves to these sudden changes and change their strategies accordingly. Due to limited resources, increase in service users, increase in equipment costs, financial and logistical problems, urgent need for after-sales services, development of communication networks, increase in wages, etc. It has become very difficult to make a decision and choose a strategy that fits the structure of the organization, and the issue of organizational resilience has been associated with great success. Based on this, the theories of crisis and disaster management also seek to create resilient societies against risks and have listed resilience as the most important factor to achieve sustainability [1]. One of the most important crises in recent years has been the contamination of the whole world with the Corona virus or Covid-19, and the involvement of the countries of the world with this epidemic has affected all their economic, political, social and cultural fields. It has been disrupted. Communication and information technology is the most important driver of innovation and growth for the economy of the countries of the world, and digital technologies and related innovations are powerful and comprehensive and have a multifaceted and indirect effect on the economy of the countries [3]. One of the industries that has been severely affected by the Corona pandemic is the information and communication technology industry And Iran Telecommunication Company, as the largest organization under this industry, has faced extensive challenges in this era. Considering the importance and necessity of the subject, this research seeks to provide a model for organizational resilience in telecommunication companies in the era of Covid-19 and to face its hazards and consequences.

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Finally, by recognizing and strengthening the factors affecting it, it is possible to increase the efficiency and productivity of the organization.

Research methodology

The present research was done with a mixed approach (qualitative and quantitative). This research is considered exploratory-descriptive in terms of data collection and developmental-applicative in terms of its purpose. Thus, in order to achieve a brief description of the experiences, attitudes and perceptions of the interviewees regarding the dimensions of the organizational resilience model in telecommunication companies, the qualitative research method and specifically, from the Strauss and Corbin grounded theory approach used [4]. Therefore, 11 managers and experts of the telecommunication company of Alborz province, who mostly worked in management positions, were interviewed. Retest reliability method was also used to calculate the reliability of the interviews. The statistical population in the quantitative part was all official and contractual employees of Alborz province Telecommunications Company (N=281). The sample size at this stage was selected based on Cochran's formula, with the number of 163 people. The questionnaire was prepared based on the opinions of the experts of the Alborz province telecommunication company and based on the Likert scale and was randomly distributed to collect data in this statistical population, which was used for data analysis. In order to check the reliability of the research data in the quantitative part, Cronbach's alpha coefficient was used, and in all cases, the alpha coefficient was higher than 0.7. To ensure the validity of the model constructs, the confirmatory factor analysis technique was used [2].

Discussion and Results

After performing open, axial and selective coding, finally 40 indicators were identified and categorized into five factors. Then, using confirmatory factor analysis and Amos software, eight indicators that had a factor load less than 0.5 were removed and 32 indicators were confirmed. The results of the research hypotheses test showed that all five identified factors have a significant impact on the organizational resilience of telecommunication companies and the factors of human resources, political and social, infrastructure and technology, economic and management and organization have had the greatest impact on organizational resilience, respectively.

Conclusion

According to the results and the factor loading of indicators, it is suggested that in order to achieve more and more stable resilience and also to provide high quality services at the standard level, it is necessary to create a suitable and safe environment. Action should be taken to increase the motivation, health,

calmness and adequate concentration of human resources. Also, there is a need for more interaction with the government to deal with sanctions and increase the budget for infrastructure development in order to maintain and increase resilience. In addition, it is recommended to develop infrastructure and equipment before the occurrence of future crises. Buying and saving IP in order to grow the stability of the network and upgrade the Uplink in order to increase the quality of service and create a balance between supply and demand, as well as increasing the necessary infrastructure to support customers in a timely and appropriate manner is also one of the necessities of this industry. Another suggestion is that the income from the increase in the number of customers and of course the increase in income caused by this crisis should be used to compensate for the lack of liquidity for the development of fiber optic network and technical equipment. And finally, the managers of the organization should be prepared to face the future crises by gaining experience from the Corona crisis at the same time as solving the problems that have arisen.

Keywords: Organizational Resilience - Resilience Pattern - Consequences of the covid 19 pandemic - Mixed Approach.

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Analysis of how the livelihood security of rural households is affected by crop area and cultivation patterns, to reduce water and livelihood risks in Iran

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Introduction
In recent years, Iran has been faced with severe water-related risks. Considering Iran's water-related hazards, policymakers formulated water policies based on changing cropping patterns. However, it seems the interconnection between rural household livelihood security and cropping patterns has been neglected in these policies. Accordingly, this study intends to determine the minimum area that can meet the rural household's livelihood security for each cropping pattern. The other main objective of the study is to identify the number of farmers exposed to livelihood insecurity if their cropping areas were limited and they did have not any option for supplementary livelihood. The findings could be useful for water policies considering both livelihood and water security.

Data and Methods
Inspired by some World Bank studies in the field of poverty, and rural livelihood, a conceptual framework, and some equations were developed to answer the main objectives of the study. The minimum area that can guarantee the rural household's livelihood security for each cropping pattern was estimated for the period 1986-2018. The other objectives such as the number of people (farmers and their households) who have been exposed to livelihood insecurity due to the size of the cropping area are estimated in 2014. All required data are gathered from the Iranian Statistics center (Agriculture Census, Population and Housing Census, Rural Households Income and Expenditure Survey, and The purchase price of agricultural products survey) and the Ministry of Agriculture-Jahad.

Results and Conclusions
The results indicate that the minimum crop area required to guarantee rural livelihood security, including such crops as wheat and beans (productions that need less water), are 10 times less than production that needs more water (like

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potatoes and vegetables). Our results also estimated that around seven million people have been exposed to livelihood insecurity due to the low per capita crop area. Thus, it is recommended that policy makers must consider the farmers whose livelihoods are dependent on farming and agriculture and establish a multi-dimensional policy considering water, food, and economy simultaneously.

Keywords: Rural Households Income and Expenditure Survey, rural Population, water policy, water security, water footprint.

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Determining patterns of water scarcity and drought risk reduction of Lake Urmia Basin through adaptation and strategic management

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Introduction

Lake Urmia is one of the centers that has suffered a water shortage due to natural and man-made factors, and in case of lack of appropriate measures, apart from security problems, it can also impose exorbitant costs on the country. This issue requires more attention and conducting more comprehensive studies from various aspects, especially intelligent basin management and integrated studies of water and soil resources and the implementation of specialized and timely programs for the supply of agricultural, drinking and industrial water. Investigations carried out during the last two decades show that the water level of Lake Urmia has decreased by more than eight meters and its area has decreased by more than 80% and has been subjected to complete drying (Shadkam, 2017). Currently, the water level of Lake Urmia is 1271 meters above sea level, the volume of water is 3 billion cubic meters and its area is between 2500 and 3000 square kilometers, and to reach the water level of 1274 meters and an area of 4300 square kilometers, it needs 14 billion cubic meters of water. Also, in order to reach the ideal water level, i.e. 1276 meters and an area of 5700 square kilometers, the volume of water should increase to 30 billion cubic meters (Asri and Ahmadi, 2018). Also, the drying of this lake can have a great impact on the life of the population living in the basin, the organisations inside the lake basin. Agriculture and economy of the region, climate change in the region and proper management of water resources and accurate knowledge of water balance components are of particular importance (Abdali et al., 2018). Since the drying up of this lake can have a great impact on the life of the population living in the basin, the organisms inside the lake, agriculture and economy of the region, climate change in the region and even political adversities, therefore it is necessary to apply proper management in order to

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adapt to the existing conditions and carry out basic planning. is inevitable (Fazli, 2014). Therefore, the main reason for the lack of water and the drying up of Lake Urmia is the lack of foresight and long-term planning, and more importantly, the lack of discipline in the management and guidance of operational plans at the basin level (Mahdavi Damghani, 2019). Basically, strategic management includes 3 stages of strategy setting, strategy implementation and strategy evaluation, which the QSPM matrix (quantitative strategic planning matrix) is proportional to the first stage, that is, strategy setting. SWOT analysis includes the systematic identification of factors with which the strategy should have the best compatibility. The logic of the mentioned approach is that an effective strategy should maximize the strengths and opportunities of the system and minimize the weaknesses and threats. If this logic is used correctly, it will have very good results for choosing and designing an effective strategy (Zangiabadi and Mousavi, 2012). In 1989, Johnson et al., in a study, introduced SWOT as a tool used in the early stages of decision making. This matrix is effective in implementing development plans if specific goals and required indicators are available (Johnson et al., 1990).

In this research, it is tried to determine the management strategies of Urmia lake basin in order to adapt to water shortage and drought in the process of comprehensive basin management using strategic management models (SWOT and QSPM). Therefore, it is necessary to first identify the strengths and weaknesses, as well as the opportunities and threats of the basin, and then determine the practical strategies, and after analyzing them, using the QSPM model, prioritize strategies to modify or complete the plans. In progress, he suggested to the relevant officials. Quantitative strategic planning matrix QSPM is an analytical method that determines the relative attractiveness of strategies. With this method, it is possible to objectively determine the various strategies that are among the best strategies, and the results of the matrix of internal and external factors are used to prepare a quantitative strategic planning matrix. In fact, this technique determines which of the selected strategic options is possible and then prioritizes these strategies (Zarrabi and Mahboob Far, 2012).

Regarding the innovation in the research topic, in general, most of the studies have been done, they have discussed why the lake dries up and also provide solutions to improve the problem of dryness of Lake Urmia. Some studies have also addressed the problems caused by the drying up of Lake Urmia and its possible damages in the future and have concluded that it is important and necessary to try to revive this lake. Also, the researches that have been carried out in fields such as water shortage or drying up of Lake Urmia have mostly focused on the environmental, economic, health and sustainable development and even political, security and geopolitical aspects, but so far not much attention has been paid to the issue of strategic planning of Lake Urmia. and so far, a detailed assessment of the strengths and weaknesses, opportunities and

threats in the comprehensive management of the Lake Urmia basin has not been done. Therefore, this research has a scientific innovation from this point of view.

Research and analysis method
There are different methods and models to investigate and analyze this issue. Each of these models has its own concept and insight and follows a special technique and instructions. Among them, the SWOT matrix, which evaluates the strengths, weaknesses, opportunities and threats of the system, is more common and famous (Hill, T. and R. Westbrook, 1997). The SWOT model is one of the group decision-making models used in It is designed to determine long-term or short-term strategy and make big and key decisions about various issues and topics. The main task of the mentioned model is to determine the strategy to improve the efficiency or the situation (Bazrafkan and Ekhsish, 2015). Therefore, the application of SWOT analysis in the field of basin management in determining the optimal conditions and logical guidelines with appropriate executive and legal support, alignment between legislative, executive, supervisory organizations and the interpretation and analysis of the current conditions governing the basin, especially in the field of comprehensive studies and even The evaluation of the system letters and the description of the study services will be in different stages of justification, semi-detailed and detailed-executive (Chang, 2006 & Huang). Therefore, the use of new methods in the review of plans and programs can be very beneficial in order to achieve the goals of management. Based on the SWOT model, appropriate strategies are developed to achieve maximum strengths and opportunities and minimize weaknesses and threats (Nikolaou et al, 2010). It is necessary to set laws and extensive trainings and simultaneously conduct studies with the mentioned approach to understand the results obtained from it (Afkhami, 2018). In this research, SWOT and QSPM models were used to determine the appropriate strategies for determining adaptation patterns to water scarcity and drought in Lake Urmia. After collecting and analyzing the information obtained from the questionnaires using SPSS software, the total and average scores obtained for each factor were calculated, as well as the normalized weight along with the weighted score using EXPERT CHOICE software. Then, based on the ranking of the weighted points from the highest to the lowest, the top 5 strategies were determined in terms of the highest weighted points for each of the strengths, weaknesses, opportunities and threats. Then the factors identified in the four modes of SO (offensive strategies), WO (conservative strategies), ST (competitive strategies) and WT (defensive strategies) were linked.

Materials and methods
In order to carry out the applied model of the research, first the current situation of the basin was investigated, then based on the models and patterns of

management and strategic planning, environmental and internal factors were investigated, and by determining the strengths and weaknesses, threats and opportunities, it was analyzed. The findings of the analysis using the SWOT model and its related matrices include: evaluation matrices of external and internal factors and the combination of both, and finally, the QSPM quantitative strategic planning matrix is prepared. To determine the strategy, examining the internal and external factors alone is not the answer, and to identify the areas that can be improved, in addition to the SWOT model, it is necessary to analyze it using the quantitative strategic planning matrix or QSPM. For this reason, after examining the SWOT matrix, the QSPM analysis method is used. In fact, the research application model is obtained from the combination of the two matrices of SWOT strategic analysis and QSPM quantitative strategic planning.

Discussion and Results
The studies conducted show that 10 factors have been identified as strengths and 17 factors have been identified as weaknesses to determine patterns of adaptation to water scarcity and drought based on the strategic management approach. Also, among the external factors (opportunities), 15 factors have been identified and 9 factors have been identified as threats.

The most important factor among the strengths of 1-preventing new development in the agricultural sector and 2-stopping all dam construction projects has been identified in the study. On the other hand, the most important weaknesses have been identified: 1- the creation of a future research center in the environmental organization and 2- the pathology of the social effects caused by the drying up of the lake. The most important opportunity for Lake Urmia 1- Education and raising awareness 2- Applying ecosystem-based management has been identified in contrast to the most important threat to the basin of Lake Urmia 1- Increasing water extraction from underground sources (drilling illegal wells) and 2- The planting of non-native and aquatic species has been identified.

Also, based on the sum total of internal and external factors, the scope of determining the strategy was determined. As explained in the methodology section of this research, the IFE-EFE matrix is used to determine the range, and according to the calculations, the strategy range was placed in a conservative position. Therefore, WO strategies will be used for ranking and prioritizing strategies for the consistent management of Lake Urmia.

In the next step, quantitative strategic planning matrix or QSPM was formed. In the quantitative strategic planning process, different strategies are examined and the best ones are selected. Meanwhile, in order to evaluate the attractiveness of each of the strategic factors in Table 4, a quantitative matrix for determining strategies compatible with water scarcity and drought for the management of Lake Urmia along with the attractiveness scores and other calculations is provided.

Conclusion

In this research, which was carried out in order to formulate and prioritize the strategy and patterns of adaptation to water shortage and drought in the Urmia catchment area, according to the different coefficients assigned to different internal and external factors, each of the influencing variables in the form of standardized matrices (matrix of internal factors and foreign) were measured and evaluated. The results obtained from the total weighted points of the matrix of internal factors showed that the management of the Urmia Lake catchment area has weaknesses in terms of adaptation to water shortage and drought in terms of internal factors, and in fact, the amount of weaknesses is more than the amount of strengths. Also, the results obtained from the total weighted points of the matrix of external factors showed that the compiled patterns are facing opportunities in terms of external factors. In other words, managers' advancement opportunities have a higher influence than threatening factors. The simultaneous analysis of internal and external factor matrices showed the general situation of the strategies related to the pattern of adaptation to water shortage and drought in the conservative area.

QSPM matrix calculations in Table 5 showed that among the optimal WO strategies, priority is related to WO5, WO2, WO3, WO1 and WO4 strategies respectively. Therefore, in order to develop patterns of adaptation to water scarcity and drought in Lake Urmia, first of all, policies should be applied in the direction of changing the cultivation pattern by identifying salt-tolerant species suitable to the conditions of the region. Then apply ecosystem-oriented management by studying and implementing the national park's ecological protection program. In the next stage, the preparation of the plan to increase employment and alternative livelihoods should be done with the participation of the people, and finally, the prevention of unauthorized withdrawals from surface water should be implemented by applying integrated management and reforming the structure of the country's divisions, as well as organizing wells and installing volume smart meters in order to establish the water market.

Keywords: Lake Urmia, Adaptation, Water scarcity, Drought , Rick.

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