



Formulating Environmental Strategies for Socio-economic Development Using Comparative Analysis, SWOT Model and AHP

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Abstract

Earth's resources are rapidly depleting and several difficulties are increasing every moment. Environmental decay is affecting economic and social development by imposing real limits to growth and deteriorating quality of life. Undoubtedly, future generations will suffer if a solution is not found. Environmental planning is a balance between development and the environment and considers the economic opportunity development, social justice and environmental aspects. To make this balance, environmental strategies are used for promoting the interaction among planners and the local community. One of the tools that help managers and planners to formulate these strategies is the use of a SWOT analysis. Also the AHP model is could be used to prioritize the factors of strategy development and planning options. In this paper, strengths, weaknesses, opportunities and threats of Haftjoy region are identified and environmental strategies for socio-economic development are formulated. Finally all of these strategies are prioritized using a combination of SWOT analysis and AHP.

Keywords: Environmental strategy, Development planning, SWOT model, Sustainable development, Policy making

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Introduction

Environmental decay is affecting economic and social development by imposing real limits to growth and deteriorating quality of life. Often, environment is seen as a source of costs (land use planning, baselines and information systems), constraints to economic activity (carrying capacity) or uncomfortable activism (NGO's and public complaints) (Diaz, 2011).

The primary goal of development planning is to improve the quality of life of human populations by means of a systematic evaluation, selection and implementation of sustainable development alternatives that reflect both environmental constraints and opportunities (Schultink, 200). The emergence of the sustainability agenda during the last three decades brought to the fore considerations of balancing economic growth with environmental and social concerns (Albrechts, 2004). Therefore, the environmental planning is transformed into a proactive agent of positive social, economic and environmental change (Karadimitriou, 2013; Tewdwr et al, 2010; Scott et al, 2013)

The debate on sustainable development and its relationship with economic development has been the catalyst for extensive research within the environmental movement, and has resulted in many institutions and global funding sources issuing guidelines and consultative documents (Brown, 1998; O'Brien et al, 2007). The rapid advance of the world trading communities towards globalization has intensified this debate.

Following the Rio Summit, a momentum for change regarding global governance of environmental commons emerged (Giddens, 1999; O'Brien et al, 2007) and in this conference, 191 countries committed to preparing national sustainable development strategies (Lafferty & Meadowcroft, 2000; UN DESA, 2004). One of the keys in meeting international commitments to achieve sustainable development is an effective planning and policy making process. A critical policy issue therefore is how to design and assess the effectiveness of alternative planning systems for sustainable development (Ellis, 2008)

In order to best serve the public, scientists and policy makers have a responsibility to recognize and respond to evolving circumstances that influence societies, economies and natural environments (Carter & White, 2012). The purpose of this paper is to ensure that all activities relating to the Environment are identified, planned and documented. In this regard, social and economical aspects should be concerned.

Material and Methods

General Attributes of the Case Study

Iranian political divisions, with refer to province of Tehran, divides Shahriar county into three major zones: Malard, Markazi and Qods. Qods, the third and the smallest zone, includes two district regions called Danesh and Haftjoy located in east and west respectively. Also, the Haftjoy district region contains one city and village (Qods city and Haftjoy village) (Figure 1).

The existence of sand and gravel mines -sourced by Karaj river's alluvial deposits- is one main characteristics of this district region that have been developed in a wide range of its center.

Today, several industrial plants and firms are located in this district. These industrial plants with sand and gravel firms affected the air condition of region as today dusty air is seen in major part of this region. Shahryar Karaj Road is main road of region district which in addition to providing access to areas inside the region, provide connect between the region and other regions and the city of Karaj. There are several region and national road in the east and northeast of Haftjoy that are one of factors to develop this region and increasing population. This region is located in the vicinity of large companies such Saipa and IranKhodro (Iranian auto manufacturers) that is another characteristic of this region. Water sources of Haftjoy are provided by both of ground and surface sources. Also farming, animal husbandry and gardening constitute another part of the region economy.

In recent decades, because of social and political developments, population growth and migration towards Tehran, Qods has become crowded and dense residential area and also land use has changed significantly.

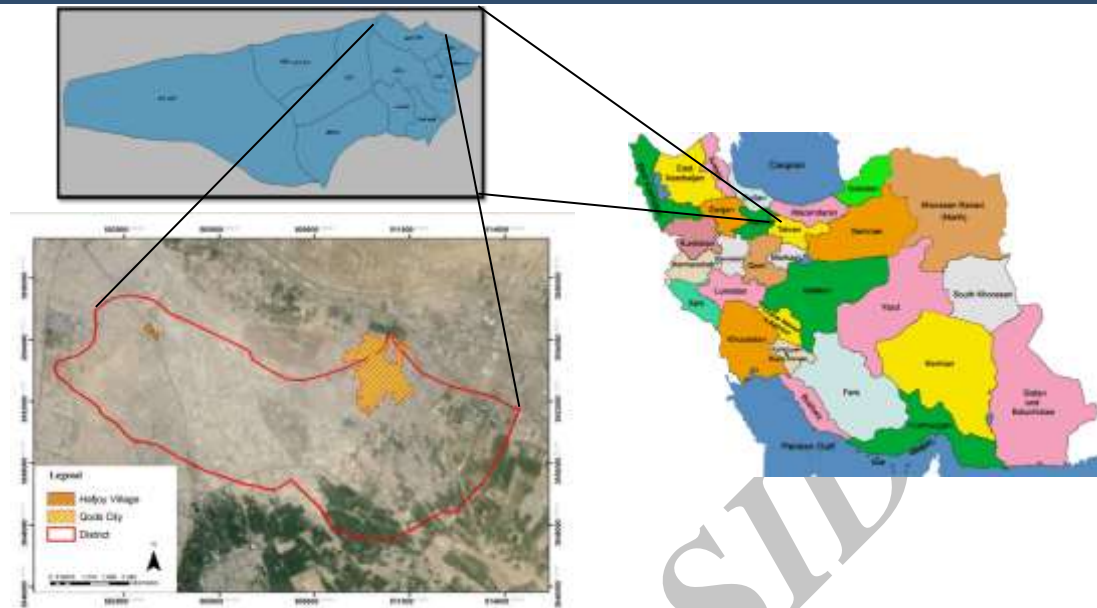


Figure 1: Location of the study area

Economic, Social, Cultural and Demographic Attributes

In this study, economic, social, cultural and demographic attributes include distribution of residential points (urban and rural), historical population changes, employed and unemployed changes, classification of economic resources (agriculture, industry, tourism and etc) and exploitation of resources.

In this study, socio-cultural, demographic, economic and environmental points of distribution (urban and rural) within the regional political developments, population (urban and rural) in the past year, the hierarchy of biological evolution based on the number of employed and unemployed population changes in population among the major groups of activities (agriculture, industry, services and trade), classifying the city's economic resources (agriculture, industry, mining, tourism) and assessment of the resources exploitation. There are two residential points in this region district include Haftjoy village and Qods city located in northwest and east respectively.

In this study, population of Haftjoy is investigated in four time periods 1365, 1375, 1385 and 1390 in terms of sex, literacy levels and employed population. It should be noted, the land uses area are used to classify economic resources. Also, in order to investigate the quality, functional hierarchy and general pattern of roads and distribution network of energy, the topographic maps at different scales (1:50000 and 1:10000), satellite images (Landsat, TM) and data collected from relevant organization are used and all of the relevant maps are provided by GIS.

Analysis Method

The main objective of development planning and particularly land use planning is adjusting logical and appropriated relationship between ecological capability and economic and social needs. So in this study, several tools and methods such SWOT model, Analysis Hierarchy Process (AHP) and comparative socio-economic analysis are used in different stages. The environmental planning suggested in this paper includes three main steps: identification, analysis and integration. This study also is set in two scales. First on a large or regional scale, the collected data is generic and is used primary in order to enable planner to understand of the area and local performance and attributes. Finally, on a local scale will focus on collection of data in terms of physical, biological and social factors that define the planning region. The purpose of this scale is obtaining a more detailed understand of natural phenomena and the human activities associated with that.

In next stages, strengths, weaknesses, opportunities and threats of Haftjoy are determined and prioritized. Then, the different stages of environmental planning are continued to reach the appropriate

solutions. In this regard, the SWOT model combined with AHP methods to provide socio-economic strategies.

SWOT analysis is a useful tool for strategic planning in environmental management, and supplies the basic foundation for identifying the situation and designing future procedures which is necessary in strategic attitude (Nikolaou & Evangelinos, 2010). SWOT analysis offers a simple way of characterizing the environment; it is an organized approach to brainstorming that helps to reveal insights that would not otherwise be apparent (Pines et al, 2007). It should be noted also that SWOT is a strategic tool accommodating internal strengths and weaknesses with external opportunities and threats. SWOT analysis is a systematic analysis for identifying these factors that formulates strategies by creating the best accommodation between internal and external factors. So through analogy of these factors, it can present four types of strategies such as SO, ST, WO and WT (Figure 2). Therefore, SWOT matrix is a tool which is used in this research in order to formulate initial strategy of instructional organization (Alonso, 2006; Manteghi & Zohrabi, 2011). When facing a situation and making a decision, we should consider the positive and negative aspects, advantage and disadvantage of this option. SWOT analysis can help us to identify the current situation and consider more compressive before making a choice (Han & Meng, 2009; Swaan, 2010)



Figure 2: The four dimensions of SWOT analysis

The AHP is an intuitively easy method for formulating and analyzing decisions. The process was developed to solve a specific class of problem that involves the prioritization of potential alternate solutions (Byun, 2001; Karimi, 2006). This method established by Saaty (1977) is a method to solve multiple criteria decision problems by setting their priorities (Saaty, 1977; Karahalios et al, 2011; Zheng et al, 2012). In the AHP, true to its name, the multi-criteria decision making problem is structured hierarchically (Figure 3). At the top of the hierarchy or the first level is the main objective of the problem. To help ease the decision process, the problem is broken down into all possible related criteria contributing to the decision process (Mat, 2007)

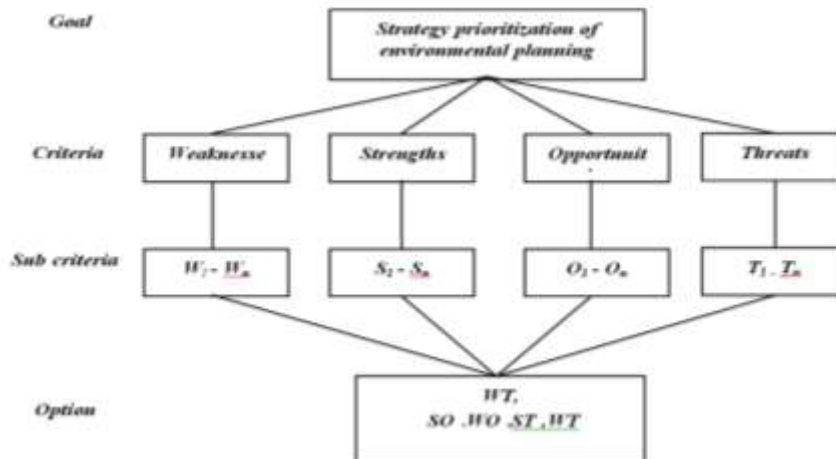


Figure 3: AHP model used for strategy prioritizing

AHP is a multi-criteria decision making technique that can help express the general decision operation by decomposing a complicated problem into a multilevel hierarchical structure of objective, criteria and alternatives (Sharma et al, 2008). AHP is an effective decision making method that performs pairwise comparisons to derive relative importance of the variable in each level of the hierarchy and / or appraises the alternatives in the lowest level of the hierarchy in order to make the best decision among alternatives (Tuzmen & Sipahi, 2011)

In this paper, in order to application of AHP model, the problem is organized primarily. This model includes three levels: the first level deals with selection of optimized strategy. The second level is concern about main factors of SWOT analysis and finally the third one presents satisfied strategies. After forming of problem structure the relationships between variables are identified and then pairwise comparisons are performed to derive relative importance of the variable in each level of the hierarchy by experts. In order to pairwise comparisons, 'Saati scale for pairwise comparisons' is used (Table 1). In first step of AHP model, pairwise comparisons matrix is formed for SWOT criteria and these factors are comprised based of the research purpose. Then same process is performed for sub criteria (strengths, weaknesses, threats and opportunities). Also the pairwise comparisons matrix is developed for options (the strategies delivered form SWOT model) and finally the deferent strategies are prioritized.

Table 1: AHP scale

Intensity of importance	definition	Explanation
1	Equal importance	Two factors contribute equally to the objective
3	Somewhat more important	Experience and judgment slightly favor one over the other
5	Much more important	Experience and judgment strongly favor one over the other
7	Very much more important	Experience and judgment very strongly favor one over the other. Its importance is demonstrated in practice
9	Absolutely more important	The evidence favoring one over the other is of the highest possible validity
2, 4, 6, 8	Intermediate values	When compromise is needed

Results and Discussion

Economic, Social, Cultural and Demographic Attributes

There are two residential points in the Haftjoy region which include Haftjoy village and Qods city located in northwest and east respectively. As presented in Table 2, there are significant changes in population of this region from 1386 to 2011 that is, the population change of these two points are equal about 2500 and 220000 respectively.

Table 2: Population changes of Haftjoy region

Date	Total population			
	1986	1996	2006	2011
Qods city	66558	138227	229354	283517
Haftjoy village	3496	1602	2828	3496

In this paper land use area is used as a factors for measuring of region`s economic resources due to the lack of information. Then industries such as sand and gravel companies and industrial sites are main economic source and farming and servicing are other economic sources. So we can express that there is an appropriate distribution of occupational spots. Particularly the Qods city has a good location from

these spots. But it should be noted that in spite of these industrial sites in the region, industrial places located out of the region have more important effeteness on population displacement.

Access Network and Urban and Regional Equipment

There are variety roads in Haftjoy region that their quality depends on using rate and population. The short roads that connect the contiguous places have local application and it could be observed in industrial zones.

Regional roads lead to link the places and sites to regional and national roads. In general this kind of road is distance between the northern industrial sites and the other places. The regional roads have a greatest role and often act a distance between major urban centers. The Sharyar – Karaj is one of the most important regional roads. State roads such Tehran- Qazvin highway is located along the north of Haftjoy (Figure 4).

In terms of hydrology and water networks, the Shahryar is located at the end of Iranian correlated central system and almost act as a playa. It is one of reasons for the abundance of aqueduct. Most rivers (such Karaj River) emanate from southern Alborz mountains inter to this region and finally end to Salt Lake.

According to studies conducted by the Dr. Monavari in 2008, using questionnaire determined that a few number of plants are equipped with wastewater treatment system and actually it can be said the wastewater of Shahryar is evacuated with incomplete treatment or without it (monavari et al, 2008). Another source of pollution is unsanitary disposal of industrial waste. It should also be noted the main fuel of this region is diesel and oil that have the potential for generate pollution.

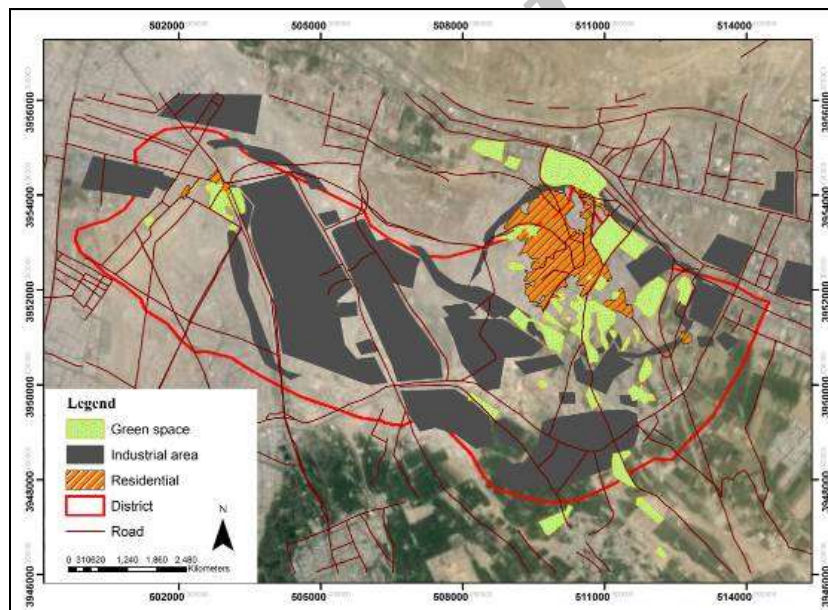


Figure 4: Access network main land use and

Land Use and Other Spatial Factors

There are no significant elevation changes in the region (the difference between the lowest and highest point is less than 200 meters). In general, the distribution of residential points has little correlation with geomorphology and the main reason for the formation and development is their situation relative to major industries and jobs and economic opportunities and attractions. As Shown in Figure 5, industry is the largest land area among other. Farms are in the second and the residential area is minimal.

Changes evaluation of land use in different periods shows that the industrial area was very small in 1986 but during very quickly growth reached to 2481 hectares in 2011. Residential area also was 50 hectares in 1986 but with population increasing and urban expanding this area reached to 902 hectares in 2011. The green space and Agricultural area that were respectively 410 and 1547 hectares in 1986 have decreased to less than 180 and 700 hectares in 2011 (Figure 6).

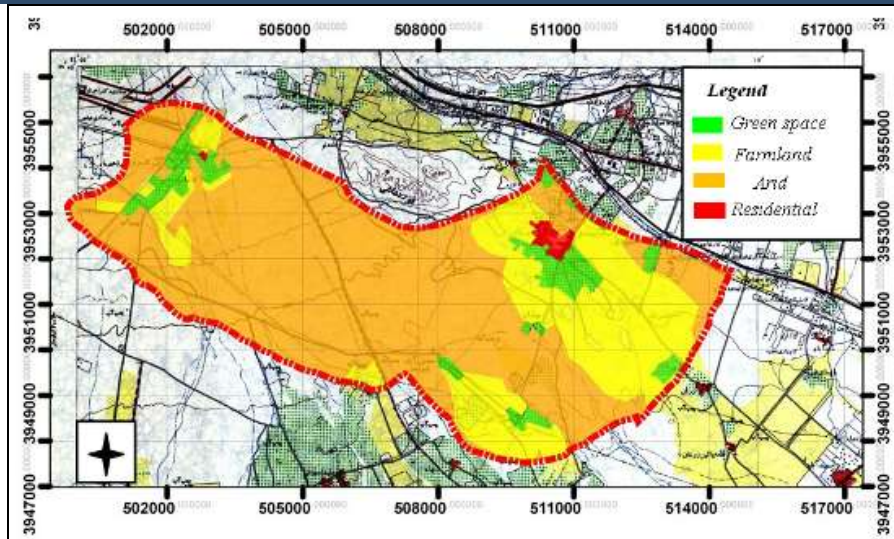


Figure 5: Land use, 1986

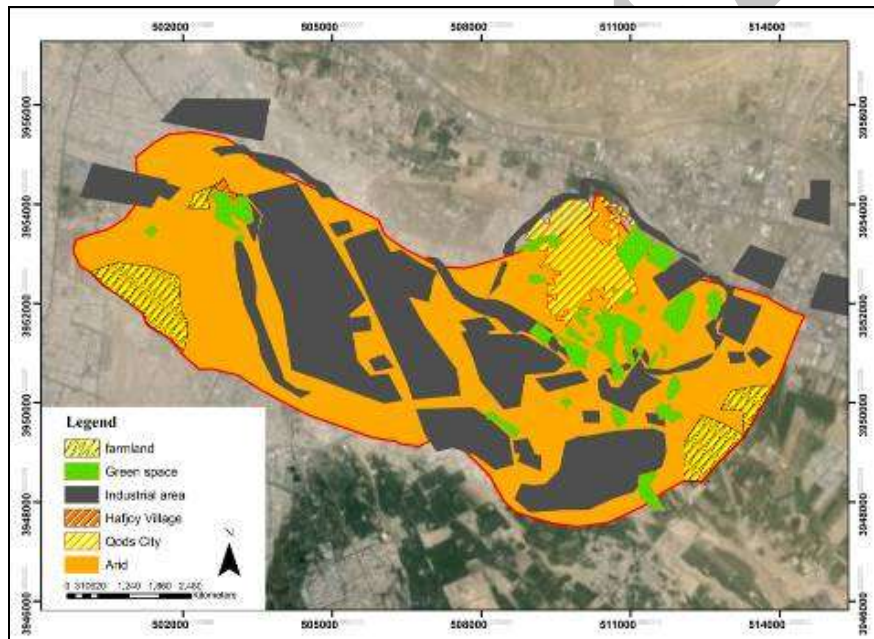


Figure 6: Land use, 2011

AHP and SWOT

After reviewing the current status of Haftjey region through field studies, literature review, review of satellite imagery, using of questionnaire as well as relevant expertly comments in regional and local scales, weaknesses, strengths, opportunities and threats were extracted in natural, manmade and economic parts and were considered as parameters of SWOT Table. Then the corresponding strategies were also developed. There are four general strategies for Haftjey planning based on SWOT model. These strategies include SO strategy that is, optimal application of opportunities through exploiting of the region strengths, WO strategy that looking for proper utilization of opportunities according to weaknesses, ST strategies in relation associated with reduction or elimination of threats by optimal using of strengths and WT strategy that reduce threats by taking into account the weaknesses.

As previously mentioned after forming the problem structure, relationships and dependencies between different variables were identified and their pairwise comparisons were performed by experts Table 3. In this way the pairwise comparisons matrix of main factors was consisted after identifying of them.

Later, sub criteria were compared together relative to main criteria. Also the strategies were compared together relative to sub criteria. Finally each of the options or strategies was prioritized. Weaknesses, strengths, threats and opportunities from SWOT analysis in priority order are presented in Table4. Also environmental strategies of research are presented in order of preference (Table 5).

Table 3: Pairwise comparisons of criteria

Criteria	S	W	O	T
S	1	3	3	4
W	1/3	1	3	3
O	1/3	1/3	1	4
T	1/4	1/4	1/4	1

Sustainable development will arguably be the next revolutionary transformation of our current societal system. Most countries have committed to adopting national sustainable development strategies. The balance between economic, environmental, and social requirements is the aim of environmental planning. To make a balance between different aspects, environmental planning is a significant tool used for promoting the interaction among planners and the local community.

Due to global changes and changes in rural and urban areas, different regions face new challenges, and require different approaches in planning. The environmental strategies can pact with these challenges and attain sustainable socio-economic development.

So far various methods and models for establishing environmental strategies in different communities are presented. In this study, the combination of SWOT analysis and AHP model was used to achieve the sustainable socio-economic development of the Haftjoy region. This framework is applied to make a strategic analysis of this region. So, this approach attempts to be interdisciplinary and conducive to the integrated planning of the rural and urban areas.

Using this method, by taking all aspects of environmental, economic and social issues, development strategies were formulated. These strategies ultimately will help to decision making for economic and social development compatible with environmental sectors.

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Table 4: SWOT matrix for Haftjoy region

		(Opportunities)	(Threats)	(Strengths)	(Weaknesses)
External factors	Natural	O1: Located in the end of underground aquifers and thus access to groundwater resources. O2: Rivers O3: Suitable climate for some crops	T1: Drought and water shortage T2: Semi-arid climate T3: Abundant of environmental pollution source T4: Sever manipulation in geomorphology T5: Air pollution T6: Groundwater pollution T7: Aquifers degradation T8: Intense urban expansion T9: Garmdare fault	S1: Several aquifers S2: Flat land S3: Prolific soil S4: Vast open space S5: Abundant natural resources	W1: Intense reduction of groundwater surface W2: Abundant pollutant resource W3: Pollution of groundwater W4: vegetation cover degradation W5: Soil erosion W6: Soil pollution W7: Surface water pollution W8: Low geomorphological diversity
	Manmade	O1: Open space around the city O2: Proximity to Tehran and Karaj cities O3: Proximity to Tehran-Karaj and Karaj-Shahryar routes O4: Crossing of Tehran-Tabriz railroad during the region O5: Proximity to industrial centers and firms	T1: Proximity of industries to residential points T2: Communication paths with low quality T3: Proximity to national communication routes as one of the pollutant resources.	S1: Suitable Topography S2: Crossing of Tehran-Tabriz railroad during the region S3: Adequate and suitable infrastructure S4: suitable soil species for urban and industrial development S5: There are variety routes with potential for expansion and widening S6: System of garbage collection	W1: Occupying of fertile land for urban development W2: Indiscriminate development of urban W3: shortage of Green space around residential and industrial places W4: Intense degradation of the land in gravel and sand extraction sites W5: Dense texture of city W6: The lack of wastewater treatment W7: Complete destruction of orchards W10: Shortage of Green space in residential area
	Socio-economic	O1: Proximity to Tehran city O2: Easy access to adjacent points O3 appropriate location of the region	T1: High rate of immigration to the region T2: Changing of livelihood way	S1: Many young people S2: High rate of literacy S3: Variety of income sources S4: appropriate employment rate S5: Cultural diversity	W1: Rapid population growth W2: farmland degradation W3: Unemployment W4: Lack of health centers W5: Lack of education infrastructure W6: High population in some areas W7: reduction of crops W8: High population of young people

Table 5: Various strategies from the SWOT analysis

<p>WO strategies (Conservative pattern) WO1: Maintaining and improving of the quality and utilization of water resources WO2: Job creation and increasing employment WO3: Green space development and reduction of environmental pollution WO4: to reduce the current exploitation of the water WO5: Incentive policies to round of industries around the residential areas WO6: Develop documented plans to prevent the disarray spread and destruction of farmland and green space WO7: Forest planting as ecological balance of city and industry WO8: Agriculture reviving considering proximity of the region to Tehran market</p>	<p>SO strategies (Aggressive pattern) SO1: developing and improving of tourism industry SO2: attracting of government and private investments on industry SO3: Increasing of healthcare, education, sports levels SO4: researching on the potential of lands for different of land use in order to create jobs SO5: Participation of private sector in creating job</p>
<p>WT strategies (Defensive pattern) WT1: population growth control and prevent concentration of population WT2: Bare land, farmlands, forests preservation WT3: Management of soil resources to avoid soil erosion and soil pollution WT4: Minimize damages caused by natural hazards WT5: improve infrastructures and facilities WT6: Reduce the current exploitation of water WT7: Compliance of industries with environmental requirements and standards</p>	<p>ST strategies (Competitive model) ST1: Agricultural development based on reduction of water consumption ST2: Aqueducts reviving and utilize them for different consumptions ST3: Capability assessment for industries establishment and new settlements ST4: Transfer the pollutant industries ST5: Reduce Geomorphological degradation ST6: improve quality of communication routs ST7: Use local educated people in government jobs</p>

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