

# Development a practical model to designation and analysis of environmental planning strategies

Mehdi Farokhnejad, Mohammad Javad Amiri

**Abstract**— Environmental planning is the process of evaluating how social, political, economic and governing factors affect the natural environment when considering development. With successful environmental planning, society wins by being able to use the area in productive ways, and the environment wins by being able to sustain itself for future generations. Environmental planning needs to develop new techniques. Which they can develop strategies and solutions to be applied strategies. One of the tools that help managers and planners to develop these strategies, that is using a SWOT analysis. In this study, by making use of the analytical network method, strengths and weaknesses due to internal factors and opportunities and threats caused by external factors were identified. Based on the findings, relevant strategies for the Environmental planning of the Tehran city and the executive programs needed for their implementation were designed. These strategies are limited for operational programs and priority. At this straight by using of Analytic Network Process, which is one of multi action methods for deciding the strategies were graded. Results shows that although the presented offensive patterns ranked best among strategies, followed by conservative, competitive and defensive patterns, but it was found that the use of a combination of the above-mentioned patterns and strategies with attention to their rankings provides the best opportunity to Environmental planning in Tehran city.

**Index Terms**— Environmental planning, Practical model, Strategy, Offensive patterns Tehran city

## I. INTRODUCTION

The scope of “environmental issues” is broad and encompasses built, social, and economic and ecological aspects [1][2]. Currently popular concepts in this field such as sustainable development and sustainability seek the integration of environment and development planning. However, there is little evidence that this integration is occurring in either mainstream development planning or environmental planning [3], but their relevance is deep.

Environmental planning is the process of facilitating decision making to carry out land development with the consideration given to the natural environmental, social, political, economic and governance factors and provides a holistic framework to achieve sustainable outcomes [4][5]. Environmental planning concerns itself with the decision making processes where they are required for managing relationships that exist within and between natural systems and human systems [6][7]. Environmental planning endeavors to manage these processes in an effective, orderly, transparent and equitable manner for the benefit of all constituents within such systems for the present and for the future. Present day environmental planning practices are the

result of continuous refinement and expansion of the scope of such decision making processes [8].

Environmental planning is the process of evaluating how social, political, economic and governing factors affect the natural environment when considering development [9]. The goal of environmental planning is to come up with a win-win situation for society and the environment. With successful environmental planning, society wins by being able to use the area in productive ways, and the environment wins by being able to sustain itself for future generations [10].

Also environmental planning is urban and regional planning with a focus on sustainability. It aims to analyze and minimize the environmental impacts of proposed construction projects and make sure they meet all environmental regulations [11]. It essentially deals with “shaping” or improving construction projects to make them easier on the earth [12]. An environmental planner largely deals with making sure that development projects comply with environmental laws and regulations [13]. They help reduce impacts, facilitate environmental permitting, and write environmental reports and documents.

There are three components of environmental planning that must be considered. First is the current status of the natural environment. This component will take into consideration the existing state of the area to be developed. This may include evaluating the existing uses, features and natural resources of the land, as well as existing infrastructure and buildings [14].

The second component of environmental planning is vision. This involves setting goals and measurable objectives and takes into consideration the rules, regulations, laws and needs of society. The third component is implementation. This involves putting the vision into action and considers the materials, personnel and technology that may be needed to carry out the plan [15].

Environmental planning is a complex study because it not only has to consider the complexities of the natural environment but also the needs and desires of humans [16].

Environmental planning is strategic challenge confronting businesses in the 21st century. As customers and stakeholders demand that global companies lead by showing corporate citizenship, the health, safety and security of both the people and the natural environment have become a litmus test for good citizenry [17]. The issues concerning the environment are not purely scientific but rely also on planning and management. They are part of corporate vision, mission, and strategy which need to be effectively planned to remain competitive. The necessity of a more sustainable use of lands and environmental resources in general, through out specific programming and management tools at different scale levels is nowadays widely shared [18].

The environmental planning in Iran is strongly interdisciplinary. Students at various university are encouraged to see the links between human behavior and environmental consequences through papers which combine

Mehdi Farokhnejad, MSc in Health, Safety and Environment (HSE), University of Tehran, Iran

Mohammad Javad Amiri, Department of Environmental Education, Planning and Management, University of Tehran, Iran.

social science and the natural sciences. The environmental planning in Iran aims to provide students with knowledge and skills for careers in sustainable development of urban and rural communities and the management of resources.

A clear planning framework helps to create sustainable communities, and a good strategy is increasingly recognized as key to effective environmental planning. Thus the designation and analysis of strategies of environmental planning at different scale levels is necessary.

Therefore the purpose of this study is designation and analysis of strategies of environmental planning in Tehran, capital of Iran.

II. MATERIAL AND METHODS

**Case study:** Tehran is the capital of Iran and Tehran Province (Fig.1). Latest statistics indicates that population of the city exceeding 8 million and its area is about 730 km<sup>2</sup>. It is also Iran's largest urban area and the largest city in Western Asia. Tehran' has 35.6833° N, 51.4167° E coordinates with an Elevation of 1,200 to 1,980 m (3,900 to 6,470 ft.) above the sea level.

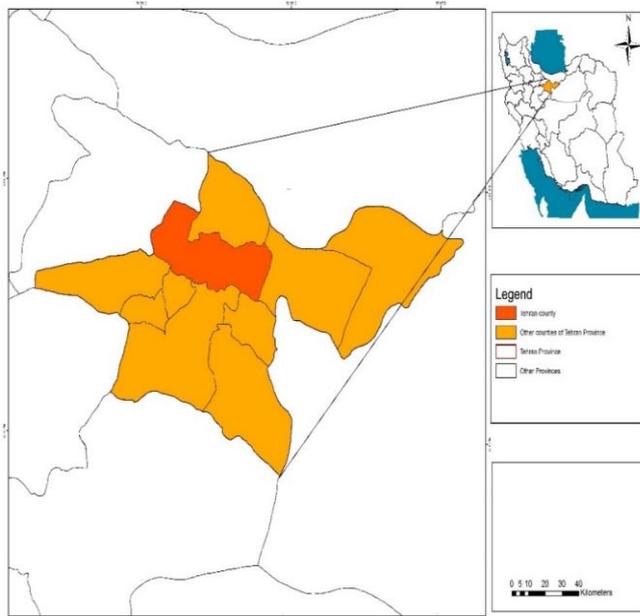


Figure1. Location of the study area

**Methods:** For environmental planning it needs some methods and new techniques that it be able to find the necessary rules, with their connection should be defined [19]. In early years, different method of strategies for environmental planning has been presented [20], in this study from combination analysis SWOT, and analytic network process method for rebuilding environmental planning strategies was used after investigating different conditions of existing parameters of natural and humanity and society. In the Tehran city, the parameters that were connected to foreign actions or internal which was for strength or weakness of environmental planning was extracted in the frame puzzle SWOT (Figure2) and after that environmental planning strategies was written (Table 1).

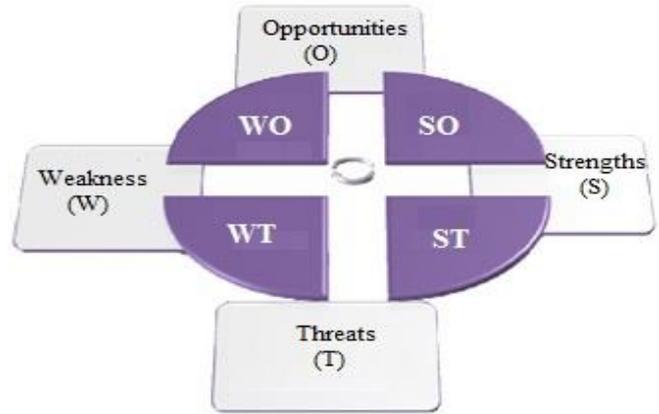


Figure2. Four dimensions of SWOT analysis [21] [22].

Table 1. SWOT for Tehran city

<p><b>Weaknesses</b>                  W1 : Lack of water and pollution of existing water resources                  W2: Management of surface water resources out of the city                  W3 : Atonal population growth and no proper distribution of general services                  W4 : Lack of health and educational facilities                  W5 : Increasing virtual jobs                  W6 : Low quality of roads inside the city                  W7 : Lack of industrial investments in the city                  W8 : Environmental degradation and increasing pollution</p>	<p><b>Strengths</b>                  S1 : Existence of holly place and historical areas and proper climate for tourism and recreational activities                  S2: Young population and educated people in the city                  S3 : Existence of sand and silt in the city                  S4: existence of fundamental infrastructures                  S5: Existence of arable lands for different uses (agriculture, forestry, recreation, ...)                  S6 : Flowing of river in the city                  S7: Presence of police and security guards in the city</p>	<p>Internal factor</p> <hr/> <p>External factors</p>
<p><b>WO strategies</b>                  (Preservative pattern)                  WO1 : Protection and development of water resources quality and exploitation of these existing resources                  WO2: Provision of employment opportunity                  WO3 : Development of green space, control and reduction of environmental pollutions                  WO4 : Improvement of natural landscape in the city</p>	<p><b>SO strategies</b>                  (Offensive pattern)                  SO1 : Development and strengthening tourism industry and recreational activities in the city                  SO2 : Fundraising from private and governmental sectors to establish industries in the city                  SO3: Increase and develop health, education and other services</p>	<p><b>Opportunities</b>                  O1 :Capital of Iran                  O2: Increasing the importance of tourism industry                  O3 :Development of environmental protection strategies in the city                  O4 : Existence of prediction and minimization of natural disasters strategies in the city                  O5: Complete the dam in the city and renovate wells                  O6 :Governmental strategies for employment</p>
<p><b>WT strategy</b> (Defensive pattern)                  WT1: Control of population growth and prevent population concentration                  WT2 : Protection of arid and agricultural lands, forest and natural and virgin areas                  WT3: Sound management of soil resources to prevent of soil erosion and pollution                  WT4 : Minimize damages caused by natural disaster                  WT5 :Establishment of infrastructures and necessary equipment in the city</p>	<p><b>ST strategies</b>                  (Competitive pattern)                  ST1: Industrial development base on reduction of water use                  ST2: Use of surface water resources for different uses in the city                  ST3: Power assessment for industries establishment, new settlements,                  ST4: Use of educated local residents in directorate position in the city                  ST5 : Provision of security and peace in the city</p>	<p><b>Threats</b>                  T1 : High rate of unemployment                  T2 :Weakness of risk management in the city                  T3 : Lack of water and locating vase area of the city in semi-arid area                  T4 :Vast soil erosion in Alborz area                  T5 : Willingness of population to accommodate in urban areas and shaping consumption culture                  T6 :Increase land use change in Tehran province                  T7 : Immigration of Afghans and settlement in the city</p>

Those four large strategies for making environmental planning in the city are discussed as follows. The concept of SO strategy is using suitable chances with benefiting from strength points of the city. WO strategy is benefiting from suitable area with attentive to city weakness. ST strategy is also in connection to reducing or omitting hazardous effects by using benefits from strength points of the city.

In addition, in the final WT strategy with pointing to weakness points of city, the hazardous results on environment is decreasing. So the resources were limited and from the other side. The strategy makes prepare, the comparative advantage, and they have this strength to consume the resources for reaching to aims. The manager and programmers trying to select those strategies that have more benefits [23] [24]. At this research for grading and electing the best strategies analytic network process (ANP), that is one of the best method for deciding multi-criteria, is used.

**Analytic Network Process (ANP):** Tomas Saaty in the years 1990 offered method for determining multi rate, that this was named analytic network process method, after many years ANP method was usual and multi purposes that is used solving the problems, analytic network process method makes a large frame that it is connected to theirs elements. [25], the results it with real world and people decision is more complicated [26], in the analytic network process method there is complicated relation between the original elements that is from substituting respective building with network construction [27].

This model is developed to improve the lack of connection between the elements and criteria in the hierarchy models [28]. ANP is categorized to two sections: 1) the criteria and sub-criteria of the hierarchy models or the controlling network which control the transactions and, 2) a network including the effectiveness of clusters and elements.

To run the ANP model in this article, first the problem is seen due to ANP model which is including four levels. The first level is known as the goal (selecting the best scenario), the second level is the main criteria of SWOT model and the sub-criteria are in the third level. Moreover, the scenarios are presented in the fourth level (Figure 3).

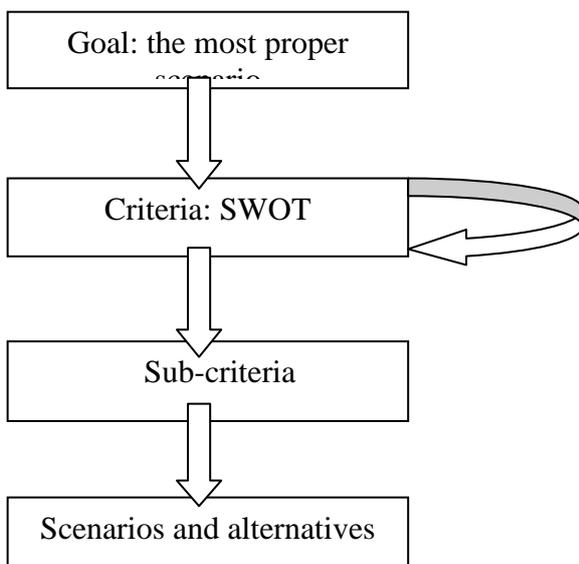


Figure 3. The hierarchy of the ANP model

After selecting the hierarchy of the model, connections and the dependency among the criteria and the pair-wise comparisons were assessed by the experts. However, the Saati's comparison model was chosen (Table 2).

Table 2. The Saati's pair-wise comparison model

Linguistic variables	Numbers
Equal	1
Interval	2
Moderate	3
Interval	4
Strong	5
Interval	6
Very strong	7
Interval	8
Extreme	9

The pair-wise matrix of the main factors is given in Table 3.

Table3. Pair-wise comparison of the main factors

Factors	S	W	O	T
S	1	2	2	3
W	1/2	1	2	3
O	1/2	1/2	1	3
T	1/3	1/3	1/3	1

After that, the dependencies among the main criteria due to their effects on each other which the assessing process is shown in Figure 4.

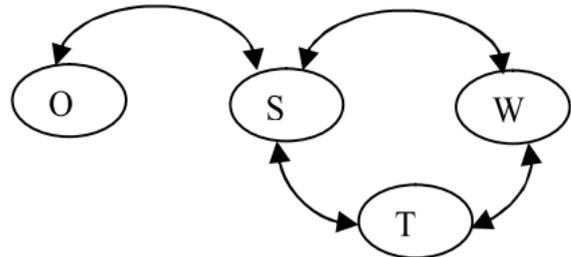


Figure4. Dependencies among the SWOT's main criteria

After that, due to Table 4, 5 and 6 the pair-wise comparisons are conducted. It should be mentioned that the opportunities are effects just by the strengths which leads not to have any matrices of the opportunities.

Table 4. Comparison matrix due to the strength

(S)	W	O	T
W	1	1/7	1/4
O	7	1	3
T	4	1/3	1

Table 5. Comparison matrix due to the weakness

(W)	S	T
S	1	7
T	1/7	1

Table 6. Comparison matrix due to the threats

(T)	S	W
S	1	6
W	1/6	1

In addition, the sub-criteria are compared to each other and the results are used in the Super Decision Software. This software was developed by the ANP group were employed in decision organization [29]. The conducted model in the software is shown in Figure 5 and the results are given at Table7.

III. RESULTS AND DISCUSSION

However, due to the Table 7 the scenario of “developing the tourism industry” is chosen as the most proper scenario than the others. Moreover, the offensive patterns have more weights which the preservative, competitive and defensive patterns are founded as the next strategies. It should be mentioned that the combination of these strategies causes the environmental sustainability.

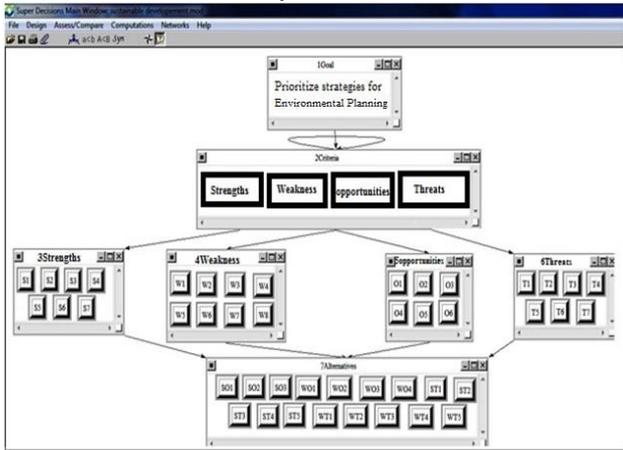


Figure 5: Network design strategies for environmental planning priorities in the software super decision

Table 7. Final result of prioritization of environmental planning strategies

Strategy	Final weight	Priority
SO1 :Development and strengthening tourism industry and recreational activities in the city	0.164	1
SO2 :Fundraising from private and governmental sectors to establish industries in the city	0.112	2
SO3 : Increase and develop health, education and other services	0.078	5
WO1 : Protection and development of water resources quality and exploitation of these existing resources	0.092	3
WO2 : Provision of employment opportunity	0.069	6
WO3 : Development of green space, control and reduction of environmental pollutions	0.043	9
WO4 : Improvement of natural landscape in the city	0.016	15
ST1 : Industrial development base on reduction of water use	0.088	4
ST2: Use of surface water resources for different uses in the city	0.043	9
ST3: Power assessment for industries establishment, new settlements	0.066	7
ST4 : Use of educated local residents in directorate position in the city	0.032	13
ST5 : Provision of security and peace in the city	0.022	14
WT1 : Control of population growth and prevent population concentration	0.033	12
WT2: Protection of arid and agricultural lands, forest and natural and virgin areas	0.047	8
WT3 : Sound management of soil resources to prevent of soil erosion and pollution	0.015	16
WT4 : Minimize damages caused by natural disasters	0.038	11
WT5 : Establishment of infrastructures and necessary equipment in the city	0.042	10

IV. CONCLUSION

As mentioned above environmental planning is the application of natural and social science to promote environmentally sound development and management of natural resources. It is a broad field, bridging the disciplines of geology, soils, hydrology, plant and wildlife ecology, law, and public policy. Therefore designation and analysis of its strategies for environmental planning is essential. Thus in this study with using a practical model, the environmental planning strategies for Tehran city was developed.

By attention to the importance original factors SWOT in respectively, the strategies are different. So the weight original SWOT factors should be noticed, but SWOT matrix is not able to weigh these rates that is depends on different strategies affect. Many studies have been done in this area. Some studies by using AHP method that is only for respective connective and equal relation. At this study from Analytic Network process method for solving this problem is used.

In SWOT matrix, patterns and strategies are defined base on 4 criteria of Strengths, Weaknesses, Opportunities and Threats. Since the importance of the main factors of SWOT is different for prioritization of strategies, therefore the main factor should be weighted. However SWOT Matrix is not able to determine the effects of the weight of these criteria on different strategies. Lots of studies and researches is done and most of them are focused on determination of the importance of the factors and weighting them by definite numbers and dependency of factors, sub factors and options are not considered. Further, some studies were done by applying AHP method which just consider hierarchy relations of factors and not same-level and reciprocal relations.

In this study Analytic Network Process were applied to solve this problem. Analytic Network Process will cause that the hypothesis of dependency of factors, sub factors and options in hierarchy structure and dependency of semi level factors and mutual dependency among the criteria are considered. In the proposed method, the first level is selecting the best strategy and other levels are SWOT factors, SWOT sub factors, and different strategies which are considered within SWOT factors in strengths, weaknesses, opportunities and threats points.

After constructing the structure, to determine the relative weight of the factors, sub factors and alternatives in decision making matrixes, pairwise comparisons and Super Decision methods were applied. The result of applying these methods reveals that the best alternative is “development and strengthening tourism industry and recreational activities in the city” which is selected from SO strategies (offensive pattern). The proposed method is capable for development and improvement. This is recommended this method will be studied by considering the hypothesis of the effects of sub factor relations and interrelations in sub factors and strategies level. To eliminate the defects, use of stakeholder ideas in pairwise comparisons will be helpful. To determine the relative importance of the components of the structure Fuzzy methods could be applied.

REFERENCES

[1] A. Castrechini, Pol, E. and Guàrdia-Olmos, J, Media representations of environmental issues: From scientific to political discourse, Revue Européenne de Psychologie Appliquée/ European Review of Applied Psychology, 2014, Vol: 64, Issue 5, Pp 213–220.

- [2] C. Sancha, Wong, C.W.Y., Gimenez Thomsen, C, buyer-supplier relationships on environmental issues: a contingency perspective, *Journal of Cleaner Production*, 2016, Vol: 112, Pp: 1849-1860.
- [3] D.S. Slocombe, *Environmental Planning, Ecosystem Science, and Ecosystem Approaches for Integrating Environment and Development*, Environmental Management, 1993, 17(3): 289-303.
- [4] A. Conacher and Conacher J, *Environment planning & management in Australia*, Oxford University Press, 2000.
- [5] Environmental Protection Agency (EPA), *Environmental planning for communities: a guide to the environmental visioning process utilizing a geographic information system (GIS)*, Office of Research and Development, DIANE Publishing, Cincinnati, Ohio, 2000.
- [6] V. Galifianakis, *Ecological Planning in Built Environment*, Paper presented at International Conference on Engineering of Reconfigurable Systems and Algorithms (ERSA), Las Vegas, NV, 2006, 26-29 June.
- [7] A. Mersal, 2016, *Sustainable Urban Futures: Environmental Planning for Sustainable Urban Development*, *Procedia Environmental Sciences*, Vol: 34, Pp: 49–61.
- [8] S.M. Wheeler, *Planning for Sustainability: Creating livable, equitable and ecological communities*, Routledge, New York, 2004. P55.
- [9] A, Drazkiewicz, Challies, E. and Newig, J. Public participation and local environmental planning: Testing factors influencing decision quality and implementation in four case studies from Germany, *Land Use Policy*, 2015, Vol: 46, Pp: 211-222.
- [10] T. Panagopoulos, González Duque, J.A. and Bostenaru Dan, M, urban planning with respect to environmental quality and human well-being, *Environmental Pollution*, 2016, Vol: 208, Pp: 137-144.
- [11] Huang, W., Corbett, J.J. and Jin, D, Regional economic and environmental analysis as a decision support for marine spatial planning in Xiamen, *Marine Policy*, 2015, Vol: 51, Pp: 555-562.
- [12] Nin, M., Soutullo, A., Rodríguez-Gallego, L. and Minin, E.D, *Ecosystem services-based land planning for environmental impact avoidance*, *Ecosystem Services*, 2016, Vol: 17, Pp: 172-184.
- [13] M.E. Portman, Natapov, A. and Fisher-Gewirtzman, D, to go where no man has gone before: Virtual reality in architecture, landscape architecture and environmental planning, *Computers, Environment and Urban Systems*, 2015, Vol: 54, Pp: 376-384.
- [14] C. Galler, Albert, C. and Haaren, C.V., from regional environmental planning to implementation: Paths and challenges of integrating ecosystem services, *Ecosystem Services*, 2016, Vol: 18, Pp: 118-129.
- [15] I.R. Hegazy, integrating strategic environmental assessment into spatial planning in Egypt, *Environmental Development*, 2015, Vol: 15, Pp: 131-144.
- [16] C.M. Raymond, Gottwald, S., Kuoppa, J. and Kytä. K. integrating multiple elements of environmental justice into urban blue space planning using public participation geographic information systems, *Landscape and Urban Planning*, 2016, Vol: 153, Pp: 198-208.
- [17] Madu, C.N, *Environmental Planning and Management*, Imperial College Press, World Scientific Publishing Co. Re. Ltd. 2007.
- [18] F.G. Maetzke and Cullotta, S, *Environmental and Forest Planning in Italy: Conflicts and Opportunities*, *Agriculture and Agricultural Science Procedia*, 2016, Vol: 8, Pp: 332-338.
- [19] M. Golusin, Ivanovic, O.M. and Teodorovic, N, the review of the achieved degree of sustainable development in South Eastern Europe—the use of linear regression method, *Renewable and Sustainable Energy Reviews*, 2011, Vol. 15, Pp: 766–772.
- [20] R. Mokhtarshahi Sani and Mahasti, P. Regenerating Regional Identity for Sustainable Tourism Development Case Study: Eslami Island Iran, Asia Pacific International Conference on Environment-Behaviour Studies, Salamis Bay Conti Resort Hotel, Famagusta, North Cyprus, 7-9 December 2011, *Procedia - Social and Behavioral Sciences*, 2011, Vol. 35, Pp:523 – 530.
- [21] A. Pierce and Robinson, R, *Planning and Strategic Management*, Yadvareh ketab publication, Tehran, 2001.
- [22] K. Golkar, K, Analytical techniques, the majority of travelers «SWOT» for application in urban design, *Journal Safeh*, 2005, No 41, Pp 2-21.
- [23] R.D. Fard, *Strategic Management*, 19th Edition, Publications Office of Cultural Research, Tehran, 2011.
- [24] S. Amalnick, Ansari nezhad, A., ansari nezhad, S. and Miri Nargesi, S, causality relationships and rank critical success factors and failure of information systems to help implement projects combined ANP and DEMATEL, fuzzy group method, *Journal of Industrial Engineering*, 2010, Vol 44, No 2, Pp: 195-212.
- [25] T.L. Saaty, *Decision Making with Dependence and Feedback the Analytic Network Process*. RWS Publications, Pittsburgh, 1996.
- [26] T.L. Saaty, *Theory and Applications of the Analytic Network Process*, RWS Publications, Pittsburgh, 2005.
- [27] A. Zebardast, Application of network analysis in urban and regional planning process, Tehran, *Journal of Art, Architecture and Urbanism*. 2009, No 41, Pp: 79-90.
- [28] M. Banar, Kose, B.M., Ozkan, A. and Acar, I.P, choosing a municipal landfill site by analytic network process, *Environ Geol journal*, 2007, Vol. 52, Pp: 747–751.
- [29] M. Momeni and Sharifi Salim, A, models and multi-criteria decision making applications, First Printing, Publisher authors Sponsored by Elixir Pharmaceuticals Inc., Pp: 218, Tehran, Iran, 2011