



## A model for presenting strategies for the urban environmental management: A case study of Tabriz

Naser Moharamnejad <sup>1</sup>, M. Badrifar <sup>2</sup>, H. Majedi <sup>3</sup>, N. Feghi-farahmand <sup>4</sup> and M. E. Ramazani <sup>1\*</sup>

<sup>1</sup> Department of Environment and Energy. <sup>2</sup> Department of Humanities and Social Science. <sup>3</sup> Department of Urban and Architecture, Islamic Azad University, Science and Research Branch, Tehran, Iran. <sup>4</sup> Department of Management, Islamic Azad University, Tabriz Branch, Iran. \*e-mail: ramazani@iaut.ac.ir, ramazani\_m\_a@yahoo.com

Received 16 January 2010, accepted 8 April 2010.

### Abstract

Population growth, the destruction and pollution of the environment and lack of an effective management system are the grave problems that the major cities of our country are facing in present. The present situation, if continued, will cause irreparable damage and create serious disorders in the major cities, including Tabriz. The aim of this paper was to present strategies to improve the present state of the urban environment of the cities in Iran. To do this, the mission statement, the prospect and long-term objectives of environment management of Tabriz as the area under study are explained in details. In order to identify the main external and internal factors influencing the quality of environment management of the city, matrices for the External Factor Evaluation (EFE) and Internal Factor Evaluation (IFE) are devised. The strategy for the promotion of the present state of environmental management is obtained with completion of the strengths, weaknesses, opportunities and threats (SOWT). Matrices to determine the degree of attractiveness of these strategies, their respective Quantitative Strategic Planning Matrices (QSPM) are devised. To devise the matrices and determine the mission statement, prospect and long-term objectives of the Tabriz environmental management the Delphi method, questionnaires and interview are used. The Kolmogorov-Smirnov test was used to determine the normal distribution of the data. The variance analysis and the comparison of the degree of attractiveness of the strategies showed that the higher quantity of the degree of attractiveness of a strategy does not imply its significance and priority over the others. To reach an answer for this need, a model has been proposed to determine and introduce the high priority strategies (QSPM). Using this model, high priority strategies to promote the present state of the environment of Tabriz were determined. The model for the development and prioritization of the urban environmental strategies proposed in this paper can serve as good example to determining the priority of the strategies for the urban environmental management, and the authorities and managers of other cities and organizations with wide range of activities can follow this model to evaluate and prioritize the strategies of their organization.

**Key words:** Pollution, strategy, city, environment, model, management, QSPM.

### Introduction

Studies show that more than 80% of the energy is used in cities. On the other hand, in the cities of the Asian developing countries urban environmental management is not a high priority. While cities are facing a whole series of disastrous consequences of changes in the global environment <sup>9</sup>, the low quality of the air, noise, heavy traffic, poor environmental management and lack of strategic planning have resulted in poor quality of life and health problems. The cities, by producing huge amounts of greenhouse gases, pollution, solid waste and overuse of natural resources, have a profound impact on the environment. The reduction of these environmental impacts is of importance but these issues are often addressed separately, hence, we use the strategy for urban environment <sup>33</sup>. Resources, processes and effects of human activity are three aspects of urban environment <sup>34</sup>. Findings of a study on the environmental state of major cities of the country show that the rate of production and spread of pollutants and the destruction of the environment has considerably increased in recent years <sup>32</sup>.

Environmental management is important in urban sustainable development. The literature about sustainable urban development covers a wide range of concepts, principles and policy prescriptions <sup>4,11,17</sup>. Practically, many authors have offered policy

instruments to accommodate sustainable urban development in various socioeconomic, institutional and political contexts <sup>2,5,8,12,13,20,26,36</sup>. The same basis, issues of various socioeconomic, institutional and political systems affect urban environmental management.

A real process for urban planning and environmental management is the common focus of many effective ideas, methods and initiatives. Urban environmental management is a scientific area of professional endeavor studies, urban planning and management from an environmental point of view. The aim of urban environmental management is to plan and take decisions for the cities. To attain this, the effective factor in the urban environmental management provides orientation for measuring the progresses made in the activities of the urban environmental management <sup>34</sup>. It is also the aim of the urban environmental management to integrate the issues of environmental planning and management in the local level. In this regard, the focus is on the general understanding of human activities in cities and their global effects. In fact, nowadays most environmental issues pertain to the human activities in cities. Ineffective use of natural resources has increased the costs and an inability to find a reliable solution for this problem will pose many serious problems in the future.

The improvement of the urban life requires effective strategies for the urban environmental management. The way the strategies are planned and implemented in public organization (such as municipalities) is quite different from that of private and public organizations, in comparison, face much more problems in this regard. These differences arise from their different objectives and working environment<sup>16</sup>. To provide strategies for the urban environmental management, the external and internal factors of this management are first investigated and then analyzed and prioritized. Finally, strategies to seize opportunities and strengths and avoid threats and weaknesses are determined<sup>15</sup>.

At present, urban management is adopting unscientific management to address environmental problems and issues have only dispersedly performed some projects to partially tackle the problems of the urban environment. The urban management could effectively overcome these problems by adopting a scientific approach and selection of proper and high priority strategies, with the prospect and long-term objectives of the environmental management in view, and by taking the internal circumstances and features of its organization, i.e. the strengths, weaknesses, opportunities and threats outside the urban environmental management system, thereby promoting the citizens environment by adapting development to the environment and by the protection, revival and development of the resources. In the present paper, Tabriz as one of the cities in the country with the environmental problems was chosen as the study area. Tabriz, with an area of 131 square kilometers, is located in the geographical are of 23°46'-46°11' Eastern longitude and 38°9'-38°1' North latitude, and lies at an average elevation of 1340 m<sup>37</sup>. Its general slope is from east to west, from north to south, and toward the center of the city<sup>24</sup>. Tabriz is the only city in the northwest with a population over a million. In 2006, its population was estimated to exceed 1,398,060 people, which was 6.5 times more than its population in 1966<sup>29,31</sup>.

The amount of pollutants emitted in the air of the city had a 30% increase from 2001 to 2007<sup>3,7,21</sup>. The municipal solid waste production has exceeded 1200 tons a day this year<sup>28</sup>. However, there has not been any effective management to dispose it; there is no adequate sewerage system to carry away over 2312 million m<sup>3</sup> of municipal wastewater produced in the city; only less than 50% of its wastewater is treated; about 13.59% of the drinking water which flows into the water distribution network, about 189,367,897 m<sup>3</sup> in 2008, was lost before use<sup>23</sup>. The surrounding fertile lands have been destroyed, and over 46% of the city's green space has been lost. The present per capita green space is low and considering only the minimum standards, the city needs 1519 hectares of green space<sup>22,30</sup>.

Approximately 3% of the energy produced and purchased in the

regional office of electricity supply of Azerbaijan that is 378 million kWh has been wasted last year<sup>35</sup>. These statistics and information indicate the inefficiency of the urban management, in the field of the environment this unsettling situation exists more or less in most major cities of the country.

In general, the aim of strategic environmental management is to reduce the adverse impact on the environment, and regarding the reduction of energy, water and paper consumption, the reduction of commute, the increase in the use of recycled material, the aim is to raise awareness about the issue of environmental diversity<sup>34</sup>. The ultimate aim of the urban environmental management is to attain a sustainable urban development<sup>14</sup>.

### Materials and Methods

In this study, after an analysis of the different influencing factors in the urban environmental management of Tabriz, intuitive judgments along with the scientific analyses were used to present the strategies for the urban environmental management of Tabriz. To do so, all the authorities and experts of the vice-presidencies of urban services, urbanization, development, social, cultural and artistic, and the organizations of traffic, parks and green space, bus service, city train company, the organization of recycling for Tabriz municipality, Islamic City Council of Tabriz, the vice-presidency of development for the office of the general governor, the center of environment sanitation, regional electricity supply, housing and urbanization, industries and mining, general office of the environmental protection, natural resources, water and wastewater system companies, the office of distribution of oil and natural resources in east Azerbaijan, the managers of the environmental non-government organizations (NGOs) of Tabriz, and professors of the universities of Tabriz in the relevant fields were selected as the research population, who actively participated all through the different stages of the study. There are eight important issues in the environment management of Tabriz. Therefore, to present strategies for the environmental management of Tabriz separate matrices of evaluation for each of these issues as the main sectors of the management were devised and then analyzed. Table 1 shows the eight main sections of environmental management of Tabriz and the number of members in strategy-devising groups. In final model for the environmental management of Tabriz, an item titled other minor factors which may affect the environment of Tabriz is also anticipated.

After mission statement and setting the prospect and long-term objectives of the environmental management of Tabriz with the help of members of these groups, main external and internal factors of the environmental management of Tabriz were determined and evaluated using EFE and IFE matrices. The strategies to improve this management were obtained through strength, weakness,

**Table 1.** Eight main sectors of the environmental management of Tabriz and the number of group members participating in devising the strategies.

Sectors of Environmental Management	Group members (persons)
Environmental Management	12
Urbanization Environmental Management	14
Energy Environmental Management	12
Green Space Management	15
Noise Quality Control Management	4
Solid Waste Management	12
Water Supply & Domestic Wastewater System Environmental management	10
Air Quality Management	9

opportunity and threats (SWOT) matrices, and the degree of attractiveness of each strategy was established by using quantitative strategic planning matrices (QSPMs). Delphi method and questionnaires were used to gather the information to set the mission statement, prospect, and long-term objectives of the environmental management of Tabriz, and also to evaluate and analyze the main influencing external and internal factors and determining the strategies for the environmental management, other suppliers of materials and energy of the city, the constitution, the document of the prospect of next twenty years of the country, five-year and regulations, the articles of association of public organizations and agencies connected with issues of environmental protection, and the opinions and suggestions of the task groups of this study were taken into consideration.

To provide Internal Factor Evaluation (IFE) Matrix and External Factor Evaluation (EFE) Matrix in cooperation with eight task groups, first the internal and external factors of the eight sectors of environmental management of the city (air quality management, water supply and domestic wastewater system environmental management, waste management, noise quality control management, green space management, energy environmental management, urbanization environmental management, and management of environmental NGOs) were determined separately and each factor was assigned a weighting coefficient between zero (unimportant) to one (very important). Then the weighting coefficients were normalized and the present state of each factor was given a score from 1 to 5, (very good = 5, above average = 4, average = 3, below average = 2, poor = 1); the weighted score of each factor was obtained through multiplying the score of each factor by its weighting coefficient <sup>6</sup>.

By preparing strength, weakness, opportunity, threat (SWOT) matrix, appropriate strategies in four strategic categories of SO, WO, WT and ST for each of the eight sectors of the environmental management of Tabriz were presented separately from the intersection points and the analysis of the strengths, weaknesses, opportunities, and threats identified in IFE and EFE matrices. The methodology for SWOT analysis <sup>1, 18, 19, 25, 27</sup> that was adopted in the present study.

Then after devising quantitative strategic planning matrices (QSPM) which were obtained through the effect of each strategy factor on the selection of the other, the final degree of attractiveness of each strategy in the eight sectors of the environmental management of Tabriz were determined. To determine the final degree of attractiveness of each strategy in relation to strategic factors, the final score of each strategic factor was multiplied by the relative attractiveness of each strategy. Based on the effect of each strategic factor on the selection of the every strategy, scoring

of the relative attractiveness of each strategy was performed by the strategy-developing task groups on a scale of 1 to 4 (1 = not attractive, 2 = somehow attractive, 3 = acceptably attractive and 4 = very attractive).

The final quantities or degrees of attractiveness of each strategy were the dependent variables of the quantitative strategic planning matrix (QSOM). These variables or final attractiveness of each strategy were determined through the multiplying the final scores of the EFE and IFE matrices by the values of the degree of attractiveness of each strategy (QSPM). Kolmogorov-Smirnov test was used to establish the normality of the values of the variables. To determine the priority and rank of strategies, the standard deviation of them was obtained and the ANOVA variance analysis and Duncan mean test were performed.

Multiple linear regression is a powerful and efficient modeling tool. In order to further accelerate its processing efficiency <sup>10</sup>, therefore, step-by-step regression (SR) as a more efficient alternative, is used in this article. Finally, the linear regression with 95% confidence interval (CI) and SPSS software were used to determine the high priority strategies and presenting a model for prioritization and determining suitable strategies for each of the eight sectors of the environmental management of Tabriz. To attain this, the results of the quantitative strategic planning matrix were analyzed and the high priority strategies for each sector were determined. The last part of the analysis was determining the high priority strategies of the environmental management of Tabriz using the results of the models obtained from the eight sectors of the management. In this regard, the first-ranking strategies of each sector were once again analyzed by the linear programming of step-by-step regression and then the high priority strategies and the model for determining high priority strategies of the environmental management of Tabriz were obtained. Table 2 shows the stages of strategy development and the model for the environmental management of Tabriz.

## Results and Discussion

The results of this study showed that the mission of the environmental management of Tabriz is to prevent and solve the problems in different sectors of the environmental management of Tabriz, reform the underlying structure of the planners, ideas, conceptions and attitudes toward the importance of the environment, to incorporate the environmental protection, basic sciences and social sciences into the process of decision-making and planning for the development, to prevent destruction and pollution of the environment of the city, to realize the Article 50 of the Constitution of the Islamic Republic of Iran, to promote the quality of life in Tabriz, and to create environmental morality.

**Table 2.** The stages of strategy development and presenting a model in the study.

Stage 1	Mission statement and setting the prospect and long term objectives the environmental management of Tabriz
Stage 2	Development of External Factor Evaluation Matrices and Internal Factor Evaluation Matrices
Stage 3	Development of Strength, Weakness, Opportunity, Threat Matrices
Stage 4	Development of Quantitative Strategic Planning Matrices
Stage 5	Performing Kolmogorov-Smirnov Test
Stage 6	ANOVA variance analysis and Duncan Mean Comparison
Stage 7	Development a model for determining the high priority strategies of each sector, management of air quality, environmental management of water supply and domestic wastewater system, management of solid waste, management of noise quality control, management of green space, environmental management of energy, environmental management of urbanization, and management of environmental NGOs using the linear programming of step-by-step regression
Stage 8	Development of a model for determining the high priority strategies of the environmental management of Tabriz using the linear programming of step-by-step regression

Moreover, a firm belief in and commitment to strike a balance between the tolerable capacity of the environment and development programs, enjoying a desirable environment and ensuring its sustainability, achieving a sustainable development in Tabriz and in the region along with the promotion of the environmental culture and morality, proper and sustainable utilization of the resources, protection and revival of the natural resources, the strengthening the structure of the environmental management of Tabriz, were determined as the prospect and ideal of the environmental management of Tabriz. The long-term objectives of the environmental management of Tabriz were the improvement of the condition of the environmental indices, optimal utilization of the resources, developing an integrated management for the environment, improvement of present state of the management of air quality control, noise control, environmental management of urbanization, water supply and domestic wastewater system, energy, solid waste, green space, management of environmental NGOs, and other minor affairs effective in the environmental management of Tabriz, evaluation of the present environmental state and trend of the city.

In view of the mission, prospects, and long-term objectives based on the results of the analysis of EFE, IFE, SWOT, and QSPM matrices of the environmental management of the city, 302 important external and internal strategic factors and 330 strategies were determined for the environmental management of Tabriz in 2008 and based on this and from the effect of the main external and internal strategies of the environmental management of Tabriz on the strategies of environmental management, 12,538 dependent variables for the quantitative strategic planning matrix of the environmental management were developed, which are shown separately for each management sector in Table 3.

The results of the ANOVA variance analysis and Duncan mean comparison, standard deviations of the dependent variables of quantitative strategic planning matrix (values of the degree of

attractiveness obtained from QSPM) of the environmental management of Tabriz collectively showed that the strategies of the management of solid waste with the highest mean score ( $m = 0.38$ ) lie in Group a, that is to say, the mean degree of attractiveness of the strategies of this sector of the environmental management has a statically significant difference with that of the other strategies of the other sectors of the environmental management of Tabriz and the strategies of this sector are the first priority to improve the environmental management of Tabriz. Strategies pertaining to water supply and domestic wastewater system with a mean score of 0.3487, urbanization with 0.34, energy with 0.3476, are categorized in Group b and are the second priority. Strategies related to air control with a mean score of 0.3614 lie in Group ab, i.e. these strategies do not have a significant difference with the strategies of Group a and b. Strategies of noise control with a mean score of 0.301 lie in Group c and are the third priority. Strategies of the environmental NGOs with a mean score of 0.2627 lie in Group d and are the fourth priority; and strategies of green space with the lowest mean score of 0.2294 in Group e are the last priority. Table 4 shows these results and the standard deviation of the values for the dependent variables of the quantitative strategic planning matrix of the eight major issues of the environmental management of Tabriz. Fig. 1 illustrates the comparison of mean scores of the important factors in the environmental management of Tabriz and their priority.

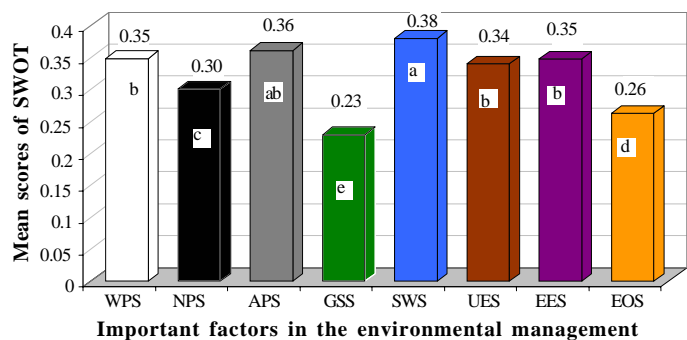
The results of the comparison of mean scores of attractiveness for the strategies of SO, WO, ST and SO in the quantitative strategic planning matrices of eight major sectors of the environmental management of Tabriz (management of air quality, environmental management of water supply and domestic wastewater system, management of solid waste, management of noise quality control, management of green space, environmental management of energy, environmental management of urbanization, and management of environmental NGOs) show that

**Table 3.** Major sectors, number of strategic factors, strategies, dependent variables of the quantitative strategic planning matrix of the environmental management of Tabriz.

Major sectors of the environmental management of Tabriz	Number of dependent variables of the Quantitative Strategic Planning Matrix of the environmental management of Tabriz	Number of the strategies	Number of important strategic
Air quality management	1880	47	40
Water supply & domestic wastewater system environmental management	1710	45	38
Solid waste management	1404	36	39
Noise pollution control management	980	35	28
Green space management	1680	42	40
Energy environmental management	1722	41	42
Environmental management of urbanization	1794	46	39
Environmental NGOs management	1368	38	36
Total	12538	330	302

**Table 4.** The results of the Duncan mean comparison, standard deviation and priority of the values of the quantitative strategic planning matrix of the eight major issues of the environmental management of Tabriz.

Sectors of the environmental management of Tabriz	Air quality	Water supply & domestic wastewater system	Noise pollution control	Solid waste	Urbanization	Green space	Energy	Environmental NGOs
Mean score of attractiveness	0.3613	0.3487	0.301	0.38	0.34	0.2294	0.3476	0.2627
Standard deviation	0.03157	0.01849	0.01345	0.01619	0.01269	0.01278	0.02453	0.00644
Priority	ab	b	c	a	b	e	b	d



WPS = Strategies of Water Supply & Domestic Wastewater System Environmental management.  
 SWS = Strategies of municipal solid waste management.  
 NPS = Strategies of noise pollution control management.  
 EOS = Strategies of environmental NGOs management.  
 GSS = Strategies of green space management.  
 APS = Strategies of air quality control management.  
 UES = Strategies of environmental management of urbanization.  
 ES = Strategies of environmental management of energy.  
 ESS = Probable strategies of urban environmental management.

Figure 1. Comparison of mean scores of the important factors in the environmental management of Tabriz and their priority.

the strategies of WT-air with a mean score of 0.4, SO and strategies of WO-solid waste with mean score of 0.39, and strategies of ST-solid waste and WT-energy with mean score of 0.38 are the high priority strategies. Fig. 2 shows the results of the comparison of mean score of the attractiveness of various strategies of WT, SO, ST, WO, quantitative strategic planning matrices for the eight major sectors of the environmental management of Tabriz. Fig. 3 demonstrates the comparison of the attractiveness of the strategies with the highest priority (Group a) in the eight major sectors of the quantitative strategic planning management of the environmental management of Tabriz.

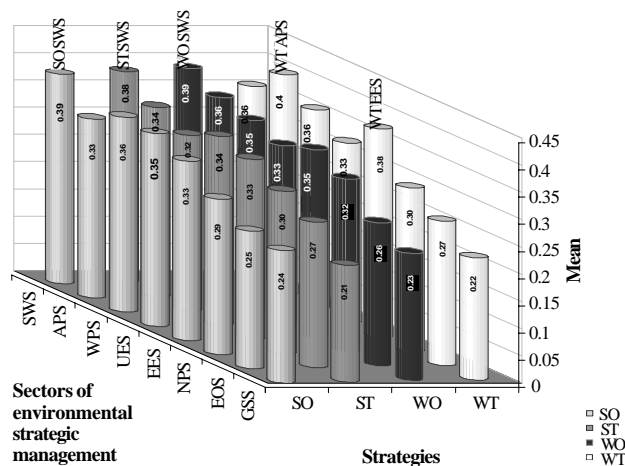


Figure 2. Comparison of the mean scores of the attractiveness of various SO, ST, WO, WT strategies of quantitative strategic planning matrices of the eight sectors of environmental management of Tabriz.

### Conclusions

The basic model for determining the high priority and suitable strategies for the environmental management of Tabriz was developed by combining the high priority strategies of air quality management, water supply and domestic wastewater system environmental management, solid waste management, noise quality control management, green space management, energy environmental management, urbanization environmental management, and management of environmental NGOs following Equation 1:

$$MUEMS_i = APS_i + WPS_i + SWS_i + NPS_i + GSS_i + EES_i + EOS_i + UES_i + ESS_i$$

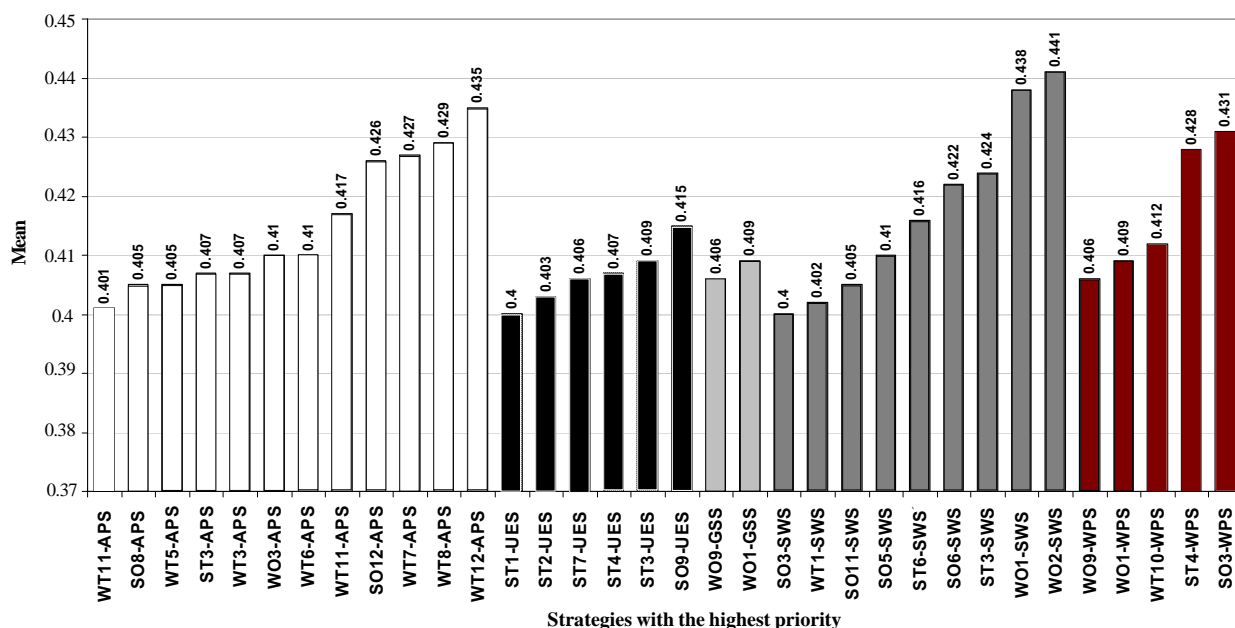


Figure 3. Comparison of the attractiveness of the strategies with the highest priority (Group a) in the eight major sectors of the quantitative strategic planning management of the environmental management of Tabriz.

The abbreviations used in present study are as follows:

MSUEM <sub>i</sub> = Model for presenting strategy of urban environmental management	GSS <sub>i</sub> = High priority strategies of model green space management
APS <sub>i</sub> = High priority strategies of model air quality control management	EES <sub>i</sub> = High priority strategies of model environmental management of energy
WPS <sub>i</sub> = High priority strategies of model of water supply & domestic wastewater system management	EOS <sub>i</sub> = High priority strategies of model environmental NGOs management
SWS <sub>i</sub> = High priority strategies of model municipal solid waste management	UES <sub>i</sub> = High priority strategies of model environmental management of urbanization
NPS <sub>i</sub> = High priority strategies of model noise pollution control management	ESS <sub>i</sub> = Probable strategies

Based on this model and the analysis of the quantities of the attractiveness of 330 strategies for the environmental management of Tabriz using the linear programming of step-by-step regression, it was found that there are 13 first priority strategies for air quality control management, 5 for water supply and domestic wastewater system environmental management, 6 for solid waste management, 7 for noise pollution control management, 7 for green space management, 5 for energy environmental management, 5 for environmental management of urbanization, and 4 first priority strategies for the management of environmental NGOs, which totaling 52 high priority strategies. The results of the analysis of these high priority strategies using a linear regression show that among these, 38 of them are of higher priority. In this final model, the most suitable and effective strategies of the environmental management of Tabriz are determined according to their priority considering the significant and value of all strategies, strength and opportunity (SO), strength and threat (ST), weakness and opportunity (WO), weakness and threat (WT), and all the main influencing factors (opportunities, threats, strengths, and weaknesses) and are represented in Equation 2:

- promotion of the awareness and knowledge of the staff and contractors working in the field of solid waste management.
- proposal, passing, and enforcing laws and regulations on urbanization and urban environment according to the present needs of the city.
- expansion of the measurement system of the quality and pollution of noise in Tabriz.
- active participation of the experts in urbanization as members of Islamic City Council of Tabriz.
- expansion of research and information technology in the municipal solid waste management of Tabriz.
- justification and drawing the attention of members of parliament to the importance and necessity of the allocation of funds from national budget plan to the implementation of air pollution management projects.
- observing the rules and regulations on the land use in accordance with the ecological capacity of Tabriz plain.
- vertical development of construction work while considering the legal and environmental considerations in the city.
- membership of the experts in the Islamic City Council of Tabriz in

$$\begin{aligned} \text{MUEMS}_i = & 0.989\text{ST3SWS} + 0.983\text{WO1SWS} + 0.975\text{WO2SWS} + 0.971\text{SO3SWS} + 0.942\text{ST6SWS} + 0.931\text{SO9UES} \\ & + 0.892\text{SO11SWS} + 0.880\text{ST4UES} + 0.878\text{WT1SWS} + 0.864\text{SO6SWS} + 0.861\text{ST3UES} + 0.837\text{SO1NPS} + 0.806\text{ST2UES} \\ & + 0.719\text{SO5SWS} + 0.698\text{ST3APS} + 0.656\text{SO12UES} + 0.632\text{SO8UES} + 0.608\text{WT8APS} + 0.602\text{WT12APS} + 0.551\text{ST1UES} + \\ & 0.535\text{WT7APS} + 0.524\text{WT3APS} + 0.514\text{WO9UES} + 0.471\text{WT1APS} + 0.469\text{WT6APS} + 0.437\text{WT5APS} + 0.419\text{WT11APS} \\ & + 0.385\text{WO3APS} + 0.290\text{SO3WPS} + 0.289\text{WT10WPS} + 0.269\text{ST7UES} + 0.188\text{WO1WPS} + 0.177\text{WO1UES} + 0.168\text{ST4WPS} \\ & + 0.144\text{SO3EOS} + 0.130\text{SO2EES} + 0.052\text{WO9WPS} + 0.049\text{ST1EOS} \end{aligned}$$

In this model, the coefficients of the strategies are the obtained standardized coefficients of the model. According to this model, the high priority strategies for the promotion of the environmental management of Tabriz are as follows:

- allocation of funds to improve the municipal solid waste management of Tabriz.
- devising a comprehensive and long-term plan for the solid waste management of Tabriz.
- observing the rules for the solid waste management of Tabriz.
- training and encouraging public to participate in separation of municipal solid waste in the place it is produced.
- financial independence of solid waste management by creating and organizing a sales management system for the sale of recycled products and compost.
- determining the urban environmental management indices in the urbanization and development sector.
- rendering the solid waste separation from the origin operational.
- optimal use of available business and service facilities.
- production of compost from wet solid waste produced in the city.

- order to propose views and opinions, and getting the environmental management plans approved and implemented.
- developing a suitable organizational structure for the management of the air quality of Tabriz.
- physical development of Tabriz according to the natural and physical features especially the geologic and climatology in accordance with the environmental laws and regulations.
- development and implementation of educational programs to train the personnel working in sectors related to the air pollution and other social groups of Tabriz.
- determining the indicator criteria, rules, and qualifications to be qualified for the managers position in the environmental, air pollution management and decision-making on the air pollution issues in order to prevent assignment of inefficient managers and to limit the influence of power exercise on the enforcement of environmental laws and regulations.
- implementation of urban projects in accordance with the environmental considerations of the city.
- developing an integrated management system for the city

including a management sector for the air quality control.

- making preparations and facilitating the cooperation of research and academic centers and establishing consulting engineers companies and seeking the cooperation in research and training in air quality control and using TV and cultural organizations.
- developing ways to reduce the adverse effects in the environment impact assessment (EIA) projects and acting on them to reduce the air pollution of the city.
- making preparations for and encouraging the activities for the air refinement by the interested environmental NGOs in the city.
- setting a comprehensive, long- and medium-term strategic objectives for the management of air pollution of Tabriz in the form of comprehensive plan for the air pollution reduction.
- enforcing the laws and regulations concerning the water supply and planning in accordance with the international and regional conventions and treaties.
- developing a system for reusing the sewage wastewater and wider use of sewage and salt water, and designing a system to use gray water as new sources of water for specific uses.
- expansion of service and business centers in different districts of the city.
- development and implementation of a comprehensive plan for the water sources of Tabriz main basin.
- environmental impact assessment of the projects and establishing an environmental management in Tabriz municipality and the urbanization and housing department of the province.
- developing an integrated environmental management system for Tabriz.
- improvement of organizational and administrative structure and status of executive management of environmental NGOs in Tabriz.
- enforcement of the laws and regulations of standards of energy saving and observing standards of energy efficiency in the centers or sectors of energy consumption.
- funding of the environmental management and water pollution control in the relevant organizations and centers or water consumption units.
- expansion of the environmental NGOs of Tabriz for consistent and sustainable use of the resources and facilities which can also serve as income source for them.

The strategies presented in the study are the most effective means for the promotion of the environmental management of Tabriz and also the best solutions for its environmental problems. By implementing these strategies, it will be possible to prevent the destruction of the environment and to reduce the negative effects of environment pollution in the city, and the funds will be allocated in an optimum way. Following the model presented here, the environmental management of Tabriz will be able to determine the second series of high priority strategies after carrying out the first series of high priority strategies suggested in the final model. To do so, it is necessary to evaluate the attractiveness of the remaining QSPM strategies using the linear programming of step-by-step regression so that new high priority strategies are obtained. The method proposed in this paper can not only serve as model for the improvement of the present state of the environmental management of the polluted cities but also be used to direct the process of the determining the high priority strategies in the strategic management planning of public organizations with a wide range of activities.

## Suggestions

Based on the proposed strategies in the present paper, Tabriz Municipality needs to establish an integrated management system, a proper organizational structure for the environmental management, and a strategic management system. We recommend that the prospect and long-term objectives set in this paper be adopted as the objectives and goals of the environmental management of the Islamic City Council of Tabriz, and all the responsibilities of planning, policy-making, continuous improvement of rules and standards of the different sectors of the environmental management of Tabriz and review of the criteria and standards of municipalities be delegated to this system. We also recommend that to finance some part of the costs and expenses of Tabriz municipality, management and revenues of water supply, power distribution, communications, and other affairs of Tabriz be delegated to Tabriz municipality as a new source of income besides other present sources. We recommend suitable time intervals be set for the strategies needed for the city management.

## References

- <sup>1</sup>Anselin, A., Meire, P. and Anselin, L. 1989. Multicriteria techniques in ecological evaluation: An example using the analytical hierarchy process. *Biological Conservation* **49**:215-229.
- <sup>2</sup>Banister, D. 1998. Barriers to the implementation of urban sustainability. *International Journal of Environment and Pollution* **10**(1):65-83.
- <sup>3</sup>CEERS 2002. Introduction of comprehensive plan of air pollution reduction. Center for Environment and Energy Research and Studies (CEERS), General Office of East Azerbaijan.
- <sup>4</sup>Daly, H. E. 1992. Allocation, distribution, and scale: Towards an economics that is efficient, just, and sustainable. *Ecological Economics* **6**:185-193.
- <sup>5</sup>Drakakis-Smith, D. 1995. Third world cities: Sustainable urban development. I. *Urban Studies* **32**:659-677.
- <sup>6</sup>Fred, R. D. 2003. Strategic management (translated by Parsayan, A. and Arabi, S. M.). Office of Cultural Investigations, Iran.
- <sup>7</sup>General Office of Environmental Protection in East Azerbaijan 2008. Report on the state of air pollution of Tabriz in 2007. General Office of Environmental Protection in East Azerbaijan.
- <sup>8</sup>Gibbs, D. C. 1994. Towards the sustainable city: Greening the local economy. *Town Planning Review* **65**:90-109.
- <sup>9</sup>Global Development Research Center (GDRC) 2006. Urban environmental management, UNDP.
- <sup>10</sup>Liu, C. H., Zhang, M. and Zheng, M. R. *et al.* 2003. Step-by-step regression: A more efficient alternative for polynomial multiple linear regression in stream cube. *Advances in Knowledge Discovery and data Mining Book Series: Lecture Notes in Artificial Intelligence* **2637**:437-448.
- <sup>11</sup>McGranahan, G. and Satterthwaite, D. 2002. The environmental dimensions of sustainable development for cities. *Geography* **87**:213-226.
- <sup>12</sup>McGranahan, G., Songsore, J. and Kjelle, M. 1996. Sustainability, poverty and urban environmental transitions. In Pugh, C. (ed.). *Sustainability, the Environment and Urbanization*. Earthscan, London, pp. 103-133.
- <sup>13</sup>Mitlin, D., Satterthwaite, D. and Stephens, C. 1996. City inequity. *Environment and Urbanization* **8**(2):37.
- <sup>14</sup>Moharamnejad, N. 2002. Principles and criteria of sustainable urban development in Iran. The Secretariat of High Council of Urbanization and Architecture, vol. I and II.
- <sup>15</sup>Moharamnejad, N. 2006. The environmental management and planning. Moallef.
- <sup>16</sup>Moradi Massihi, V. 2002. The strategic planning in metropolitans. Urban Process and Planning Company.

- <sup>17</sup>Niemeijer, D. 2002. Developing indicators for environmental policy: Data-driven and theory-driven approaches examined by example. *Environmental Science and Policy* **5**:91-103.
- <sup>18</sup>Pearce, J. A. and Robinson, R. B. 1988. *Strategic management: Strategy formulation and implementation*. Oxford Publication, UK, 450 p.
- <sup>19</sup>Pesonen, M., Kurttila, M., Kangas, J., Kajanus, M. and Heinonen, P. 2001. Assessing the priorities using AWOT among resource management strategies at the Finnish forest and park service. *Forest Science* **47**(4):534-541.
- <sup>20</sup>Pugh, C. 2001. Sustainable urban development: Some millennial reflections on theory and application. In Pugh, C. (ed.). *Sustainability, the Environment and Urbanization*. Earthscan, London, pp. 21-49.
- <sup>21</sup>Ramazani, M. E. and Nakhostindavar, S. 2007. Study of diffuse pollution from transportation in the city of Tabriz. A Research Project, Department of Environment, Islamic Azad University, Tabriz.
- <sup>22</sup>Ramazani, M. E. and Tanhayi, C. 2008. The optimum quantity of Tabriz green space. A Research Project, Department of the Environment, Islamic Azad University, Tabriz.
- <sup>23</sup>Ramazani, M. E. and Salehashemi, H. 2008. A model for the optimum water use in Tabriz. A Research Project, Department of Environment, Islamic Azad University, Tabriz.
- <sup>24</sup>Roostayi, *et al.* 2006. Environmental risks and their effects on the physical development of Tabriz. A Research Project, Tabriz University.
- <sup>25</sup>Saaty, R. W. 1987. The analytic hierarchy process and SWOT analysis what it is and how it is used. *Mathematical Modeling* **9**:161-178.
- <sup>26</sup>Satterthwaite, D. 1997. Environmental transformations in cities as they get larger, wealthier and better managed. *The Geographic Journal* **163**(2):216-224.
- <sup>27</sup>Srivastava, P. K., Kulshreshtha, K., Mohanty, C. S. *et al.* 2005. Stakeholder-based SWOT analysis for successful municipal solid waste management in Lucknow, India. *Waste Management* **25**(5):531-537.
- <sup>28</sup>The Municipality of Tabriz 2008. Report of solid waste condition 2007. Municipality of Tabriz.
- <sup>29</sup>The Organization for the Management and Planning of East Azerbaijan 2005. The basic logistic plan of East Azerbaijan. *Synthesis of Studies and Basic Logistic Plan*. Vol. 6, Tabriz.
- <sup>30</sup>The Organization for Parks and Green Space of Metropolitan Tabriz 2008. The report on the performance of the organization for parks and green space of metropolitan Tabriz in 2007. Tabriz Municipality.
- <sup>31</sup>The Iranian Center of Statistics 2007. A summary of the public and housing census, 2006. The Iranian Center of Statistics.
- <sup>32</sup>The Vice-presidency of the Training and Planning of the Organization for the Environmental Protection 2005. The second report on the state of the environment in Iran (SoE). The Organization for the Environmental Protection.
- <sup>33</sup>UNEP 1997. *Environmental Planning and Management (EPM)*. Souise Book. 3 vols. Habitat and UNEP, Nairobi.
- <sup>34</sup>UNEP and UNDP 2005. *Environmental Planning and Management*. The EPM Guidebook is an Output of the Sustainable Cities Programmed, a Joint Initiative of UNEP, UNCHS and UNDP.
- <sup>35</sup>Vice-presidency of Planning and Research of Regional Power Office of Azerbaijan 2008. An analytical and detailed report on power industry of Azerbaijan in 2007. Regional Power Supply Company of Azerbaijan.
- <sup>36</sup>Wei, T. and Shi, C. 2006. Urban environmental management in Shanghai: Achievements, problems, and prospects. *Environmental Management* **37**(3):307-321.
- <sup>37</sup>Zista Consulting Engineers 2006. A detailed plan. The organization for housing and urbanization of East Azerbaijan.