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ORIGINAL RESEARCH PAPER

# A Strategic Management Plan for Reducing Air Pollution Using the SWOT Model: A Case Study of District 2 of Tehran Municipality

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**Abstract:** Tehran is reportedly one of the most polluted cities in the world, so that a serious measure is needed to provide simple and practical solutions for effectively reducing and eliminating air pollution in this city. This study aimed to introduce feasible strategies to reduce air pollution in District 2 of Tehran Municipality regarding the existing conditions and facilities using a SWOT model. In the present survey using SWOT analysis, first the strengths, weaknesses, opportunities and threats of air quality management were identified exploiting the opinions of experts in the study district, followed by evaluating via IFE and EFE matrix tables and determining their weighted scores. The situations of internal and external environmental factors were analyzed by a set of weighted points. Then, through SWOT matrix, the air pollution management strategies were identified in the district. Finally, the obtained strategies were prioritized employing Quantitative Strategic Planning Matrix (QSPM). The scores from assessing internal (2.02) and external (2.66) factors revealed that air quality management of the study district is in a conservative situation. The SWOT matrix results presented 21 strategies, 6 of which were in the conservative situation. Based on the prioritization of the QSPM for 6 strategies, the highest attractiveness was related to " *Implementing a comprehensive energy management plan for vehicles and industries and plan for the use of clean energy* " with a total attractiveness score of 10.36 for the study district. In conclusion, the result showed the efficiency of SWOT matrix in the air quality management of the study area.

**Keywords:** Air Pollution Management, Strategic Planning, SWOT Model, QSPM, Tehran



## 1. Introduction

Air is one of the basic and important factors in the life of living beings, including humans, animals and plants, and a moment of life is impossible without air (Sadigh et al. 2020). Air pollutants and the phenomenon of dust are known as of the biggest environmental-climate disasters (Mostofie et al. 2014; Fekri et al. 2018). The air in Tehran, the capital of Iran, is highly polluted for a variety of reasons, including non-standard vehicles, poor gasoline quality, and emissions from industrial activities. Some days, especially in cold seasons, the phenomenon of air temperature inversion and excessive pollution inevitably leads to the closure of schools and government centers (Rajaei 2018).

Sharipour and AkbariBidokhti (2015) investigated the spatial and temporal dispersions of air pollutants over Tehran in cold months of 2011-2013. According to their results, the spatial-temporal distribution of the average pollutants during December 2012 showed that the concentration of gaseous pollutants increased from south to north and the concentration of particulate matters elevated from north to south and from east to west. Karampour et al. (2016) investigated the air temperature inversion of Tehran and concluded that, according to the Hafter critical inversion method, the major temperature inversion leading to air pollution in Tehran follows subsidence type. Research also documents that wastage of gasoline from gas stations is a major source of air pollution and volatile organic compounds; in Tehran, 5200 liters of gasoline is wasted daily, which causes air pollution in and around the stations. The average concentration of gasoline in the area of the stations was between 8 to 16 times greater than the threshold for workplaces and 250 to 500 times greater than the standard of breathing air (Keshavarzi Shirazi et al. 2004). On the other hand, the description of the geographical features of Tehran from topography to human issues shows that the natural features of Tehran have a great effect on the urban air pollution (Emami et al. 2013).

Organizations are constantly making decisions and planning. Therefore, it is necessary for any decision-making and strategic planning in the organization to recognize the current situation by examining the internal and external environmental factors. In other words, needs assessment and situation analysis identify opportunities and threats to the environment, based on which the goals are set regarding the previous identification of intra-organizational strengths and weaknesses, thus identifying organizational procedures and policies. This helps management to take a coordinated and integrated approach to the opportunities and threats of the external environment and to achieve its goals properly (Fataei and Seiied Safavian 2017). Therefore, the use of strategic management methods can suggest appropriate solutions to control air pollution in Tehran, so that a proper and executive management plan without specialized and scientific complexities can effectively reduce the urban air pollution (Rajaei 2018).

There are various methods to formulate strategic plans, among which SWOT analysis has been recruited to identify and set optimal strategies for organizations, resulting in four categories of strategies: strength-opportunity, weakness-opportunity, strength-threat and weakness-threat (Yusefi Golboteh et al. 2016). Hence, one of the most appropriate techniques for strategy planning and analysis is the SWOT (strengths, weaknesses, opportunities and threats) analysis or matrix, which is employed currently as a suitable instrument for performance analysis and strategy presentation by designers and evaluators (Di Novi 2010), so that this method has been selected in our research. The SWOT method uses Quantitative Strategic Planning Matrix (QSPM) to prioritize the existing strategies (Allahyari et al. 2017).

Ataeifar et al. (2012) implemented the SWOT matrix to evaluate the efficiency of Bus Rapid Transit (BRT) system of Tehran in the sustainability, and presented strategies for using the public transportation system and its impact on reducing the air pollution.

The present study aimed to investigate the situation of urban air pollution in Tehran to provide management strategies using the SWOT analytical model to reduce air pollution caused by natural and man-made activities in District 2 of the city.

## 2. Materials and Methods

The study area is the District 2 of Tehran Municipality, which consists of 9 regions and 21 neighborhoods and has an area of 47.1 square kilometers and a population of 692579, in the middle and northern part of Tehran. In order to formulate management strategies in this study, strengths and weaknesses (internal strategic factors), opportunities and threats (external strategic factors) affecting air pollution in the study area were identified and classified using the opinions of experts.

The statistical population for completing environmental factors and weight comparison included the chairman, deputies and managers and all experts related to the air quality management in the District 2 of Tehran Municipality. The response rate was 20 subjects in the specialized fields of air pollution management, environmental engineering, environmental health expert and urban planning management with at least 5 years of experience. The relative weights of each of the groups of strength, weakness, opportunity and threat were calculated through the tables of internal (strength and weakness) and external (opportunities and threats) factors, Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE). Then, the air pollution management strategies in the District 2 of Tehran Municipality were identified through the SWOT matrix. Combining the factors of analyzing strengths and weaknesses, opportunities and threats with each other, in fact, is the basis for developing four types of strategies in the SWOT matrix as follows (Tehrani et al. 2010):

1. Integration of Strength-Opportunities (SO)
2. Integration of Strength-Threats (ST)
3. Integration of Weakness-Opportunities (WO)
4. integration of Weakness-Threats (WT)

After identifying the strategies in the SWOT matrix, the attractiveness score (AS) of the strategies was prioritized using the QSPM method (Saaty T.L 2000). Following the formation of QSPM, the strategies in the SWOT matrix cells were prioritized, as follows:

5. External opportunities and threats and internal strengths and weaknesses of air quality management in the District 2 of Tehran Municipality were listed in the right column of QSPM. Then, the scores of each of these critical success factors, according to the EFE and IFE matrices, were entered into the second column.
6. Considering the second stage of formulation (integration stage), feasible and executable strategies were written in the top row of the QSPM matrix. Each strategy consisted of two columns of attractiveness scores and strategic attractiveness.
7. The scores were allocated by managers, experts and officials related to air quality control of District 2 of Tehran Municipality based on the effect size and attractiveness score of each internal and external factor in the range of scores between 1 to 4 to the relevant strategy, which is called the attractiveness score, so that if the factor had no effect on the formulation or selection of the strategy, it would receive an indifference (or zero) score.
8. Strategic attractiveness was calculated by multiplying the weight of each factor by the attractiveness score.
9. The numbers of the attractiveness column of each strategy were added to get the total attractiveness of each strategy.
10. Based on the score obtained from the total attractiveness of each strategy, the strategies were prioritized from the highest score to the lowest score. The attractiveness score was included in the QSPM table in the following order.

1 = Unacceptable
2 = Acceptable

3 = Probably acceptable
4 = Very acceptable

Then, internal strengths were compared with external opportunities to develop SO strategies and internal weaknesses were compared with opportunities outside the organization to develop ST strategies. The WT strategy was identified by comparing internal weaknesses with external threats. Finally, attractiveness and strategies were prioritized using IFE and EFE matrices as well as SWOT matrix and QSPM results (Nofrizal and Widayat 2018).

## 3. Results

Tables (1) and (2) show the results of analyzing the internal factors through the IFE matrix and the external factors through the EFE matrix, respectively. Accordingly, 20 IFEs (10 strengths and 10 weaknesses) and 20 EFEs (10 strengths and 10 threats) were identified in the field of air quality management in District 2 of Tehran Municipality. As seen in the IFE table, the total weighted score of the internal factors is 2.06, which is greater than 2, indicating that Urban Air Quality Management Organization of Tehran has acted relatively well in using strengths to deal with weaknesses, but not to the desired extent.

To form the IFE matrix, after identifying the internal strategic factors, in the second column, each factor (strengths and weaknesses) was assigned a weighting factor between zero (non-significant) and one (significant). To this end, the normalization method has been used. In the third column, the current status score of each factor was determined according to the following criteria:

Very good = 4, above average = 3, average = 2 and poor = 1

In the fourth column, the weighted score of each internal factor was calculated by multiplying the two status point parameters by the weight, indicating the minimum, maximum and mean total weighted scores of 1, 4 and 2.5, respectively.

Table 1: Internal Factor Evaluation (IFE) matrix

| Internal strategic factors | | | | |
|---|---|---|---|---|
| No. | Strengths (S) | Weight | Available scores | Weighted scores |
| 1 | Existence of environmental department in the municipality | 0.05 | 4 | 0.2 |
| 2 | Requirement of technical inspection of vehicles | 0.03 | 4 | 0.12 |
| 3 | Existence of laws and regulations in the municipality regarding air pollution | 0.04 | 3 | 0.12 |
| 4 | Enforcing policies such as even and odd license plates, and prohibiting traffic planning | 0.03 | 4 | 0.12 |
| 5 | Making policies in line with other organizations in charge of air pollution and compliance with national environmental standards | 0.04 | 3 | 0.12 |
| 6 | Allocating credit and meeting of traffic and air pollution management working groups | 0.02 | 2 | 0.04 |
| 7 | Establishing rapid bus transportation (BRT) system in different routes | 0.04 | 3 | 0.12 |
| 8 | Applying information technology (IT) and intelligent control in traffic management | 0.04 | 2 | 0.08 |
| 9 | Government investment in public transport | 0.02 | 2 | 0.04 |
| 10 | Obtaining valid certificates of ISO 14001 and green award by the municipality | 0.02 | 2 | 0.04 |
| No. | Weaknesses (W) | Weight | Available scores | Weighted scores |
| 1 | Low willingness of people to use public transport and insufficient training in this area | 0.04 | 3 | 0.12 |
| 2 | Lack of quality and quantity of public transport, especially in the northern part of the district | 0.07 | 2 | 0.14 |
| 3 | Exhaustion of the city bus fleet and increase in the level of pollutants emitted from them | 0.08 | 1 | 0.08 |
| 4 | Lack of public parking lot in public transport terminals and busy subway stations | 0.04 | 1 | 0.04 |
| 5 | Absence and non-observance of efficient rules to prohibit entry to crowded and high-traffic centers | 0.03 | 1 | 0.03 |
| 6 | Absence of appropriate infrastructure, culture and training for the use of bicycles on urban routes | 0.05 | 1 | 0.05 |
| 7 | Failure to estimate the economic and social costs caused by air pollution | 0.06 | 1 | 0.06 |
| 8 | Failure to allocate sufficient funds to manage traffic and air pollution. | 0.04 | 2 | 0.08 |
| 9 | Poor urban and traffic management in the main and secondary arteries | 0.04 | 2 | 0.08 |
| 10 | Growing trend of building density and high-rise construction in the district | 0.08 | 2 | 0.16 |
| 11 | Growing trend of population and migration to this district | 0.03 | 1 | 0.03 |
| 12 | Existence of urban fine texture in this district | 0.05 | 2 | 0.1 |
| 13 | Weaknesses in strategic vision and long-term environmental planning in urban planning | 0.05 | 1 | 0.05 |
| 14 | Failure to implement new and optimal policies of encouragement and punishment to prevent the emission of air pollutants by mobile and fixed sources | 0.02 | 2 | 0.04 |
| | Total | 0.12 | | 2.06 |

In order to form the EFE matrix, after identifying external strategic factors, in the second column, each factor (opportunity and threat) was assigned a weight coefficient between zero (non-significant) and one (significant). In the third column, the current status score

of each factor was determined according to the following criteria:

Very good = 4, above average = 3, average = 2 and poor = 1

In the fourth column, the weighted score of each external factor was calculated by multiplying the two status point parameters by the weight.

As shown in Table 2, the total weighted score of internal factors was 2.61, which is higher than 2, indicating that the Urban Air Quality Management Organization of Tehran has acted relatively well in using opportunities to deal with threats, but it is not at the desired level.

Table 2: External Factor Evaluation (EFE) matrix

| External strategic factors | | | | |
|---|---|---|---|---|
| No. | Opportunities (O) | Weight | Available scores | Weighted scores |
| 1 | Existence of modeling the dispersion and emission of air pollutants as a management tool | 0.07 | 3 | 0.21 |
| 2 | Existence of valid international standards for car production and fuel quality | 0.05 | 3 | 0.15 |
| 3 | Existence of new automotive technologies in the world (hybrid vehicles) | 0.05 | 3 | 0.15 |
| 4 | Existence of public transportation technology and new and clean fuels in the world (metro, monorail, biodiesel fuel, etc.) | 0.05 | 4 | 0.20 |
| 5 | The effect of holding conferences and activities of NGOs in the field of air pollution in raising public awareness | 0.03 | 3 | 0.09 |
| 6 | Existence of research and researchers in the field of air pollution management | 0.04 | 3 | 0.12 |
| 7 | Existence of air pollution monitoring stations by the Environmental Protection Agency | 0.03 | 3 | 0.09 |
| 8 | Existence of green production technology and studies of green city components | 0.08 | 4 | 0.32 |
| 9 | Existence of mandatory laws on air pollution and clean air standards | 0.07 | 4 | 0.28 |
| 10 | Requiring industries to provide self-reported evidence for the release of air pollutants | 0.03 | 4 | 0.12 |
| No. | Threats (T) | Weight | Available scores | Weighted scores |
| 1 | Failure to use the knowledge and skills of experts and models from other countries to manage air pollution and urban planning | 0.05 | 2 | 0.10 |
| 2 | Insufficient cultural and educational programs in promoting environmental culture and air pollution | 0.06 | 2 | 0.12 |
| 3 | Failure to observe the legal distance from the privacy of residential areas by small workshops in this district | 0.03 | 2 | 0.06 |
| 4 | Failure to observe environmental parameters such as the prevailing wind direction in the establishment of industries | 0.04 | 2 | 0.08 |
| 5 | Existence of indirect video media advertisements in the use of private cars (driving scenes and high model cars) | 0.04 | 2 | 0.08 |
| 6 | Permission to enter too many personal vehicles into the city fleet regardless of available capacity | 0.05 | 1 | 0.05 |
| 7 | Population growth due to the political, economic and social centrality of Tehran | 0.08 | 1 | 0.08 |
| 8 | Failure to use proper ventilation system in surrounding industries | 0.05 | 2 | 0.10 |
| 9 | Lack of regional view on air pollution emissions, and the phenomenon of roundtables | 0.07 | 1 | 0.07 |
| 10 | Ignoring the use of renewable energy | 0.07 | 2 | 0.14 |
| | Total | 0.12 | | 2.61 |

Based on the integration of weakness, strength, opportunity and threat factors in the SWOT matrix, four strategies were obtained as Table 3.

Table 3: Quadruple strategies based on SWOT matrix (Author, 2018)

| No. | Strength-Opportunities (SO) strategies |
|---|---|
| SO1 | Use of new knowledge and technologies to change the design of car engines |
| SO2 | Use of incentive policies for the import of spare parts and cars with minimum pollution at a reasonable cost to the customer |
| SO3 | Establishing a mechanism and providing optimal facilities to applicants to remove worn-out vehicles from the city fleet and replacing them with vehicles with clean fuel and production technology |
| SO4 | Informing the district to encourage the use of public transport through interaction with NGOs |
| SO5 | Carrying out inspections and audits at technical inspection stations and dealing severely with violators |
| No. | Strength-Threats (ST) strategies |
| ST1 | Designing and establishing a monitoring system and evaluating the environmental indicators for air pollution management in the municipality |
| ST2 | Renovating old infrastructure, attracting private participation and providing green city indicators for the implementation of strategic management to reduce air pollution |
| ST3 | Optimizing the quality and quantity of the public transport fleet to encourage people to use it |
| ST4 | Assessing environmental performance in the production of domestic cars |
| ST5 | Unconditional withdrawal of small workshops from the city limits |
| No. | Weakness-Opportunities (WO) strategies |
| WO1 | Implementing scientific and practical projects to evaluate the components of the green city (such as e-city, reducing administrative bureaucracy, etc.) with a clean air approach |
| WO2 | Implementing a comprehensive energy management plan for vehicles and industries and plan for the use of clean energy |
| WO3 | Strict control and application of incentive and punishment policies in the production of domestic cars and compliance with standards in production fuels |
| WO4 | Estimating cost index - socioeconomic benefits of air pollution damage |
| WO5 | Attracting external funding for the development of public transportation technology, and applying alternative fuels (such as biodiesel) and fuel quality improvement technology |
| WO6 | Evaluating the extent of air pollution in areas without pollutant measuring stations using modeling and informing the authorities and the public about the spatial distribution of air pollutants |
| No. | Weakness-Threats (WT) strategies |
| WT1 | Receiving high tolls for vehicles entering highly polluted areas |
| WT2 | Implementing heavy tax policies and dealing strictly in requiring industries to comply with environmental laws |
| WT3 | Building culture and educating "*Use of a private car only when necessary*" through the neighborhood house |
| WT4 | Providing compulsory driving culture education and its relationship with increasing air pollution emission to people through neighborhood house, schools and mosques |
| WT5 | Use of private sector financial investment and knowledge of leading countries for the optimal infrastructure of bicycle lanes |

To achieve strategies to reduce air pollution in the District 2 of Tehran Municipality and develop macro strategies, the scores obtained from IFE (Table 1) and EFE (Table 2) matrices were placed in the vertical and horizontal dimensions of the chart, followed by determining the strategic situation of the organization to reduce air pollution in the study area (Figure1).

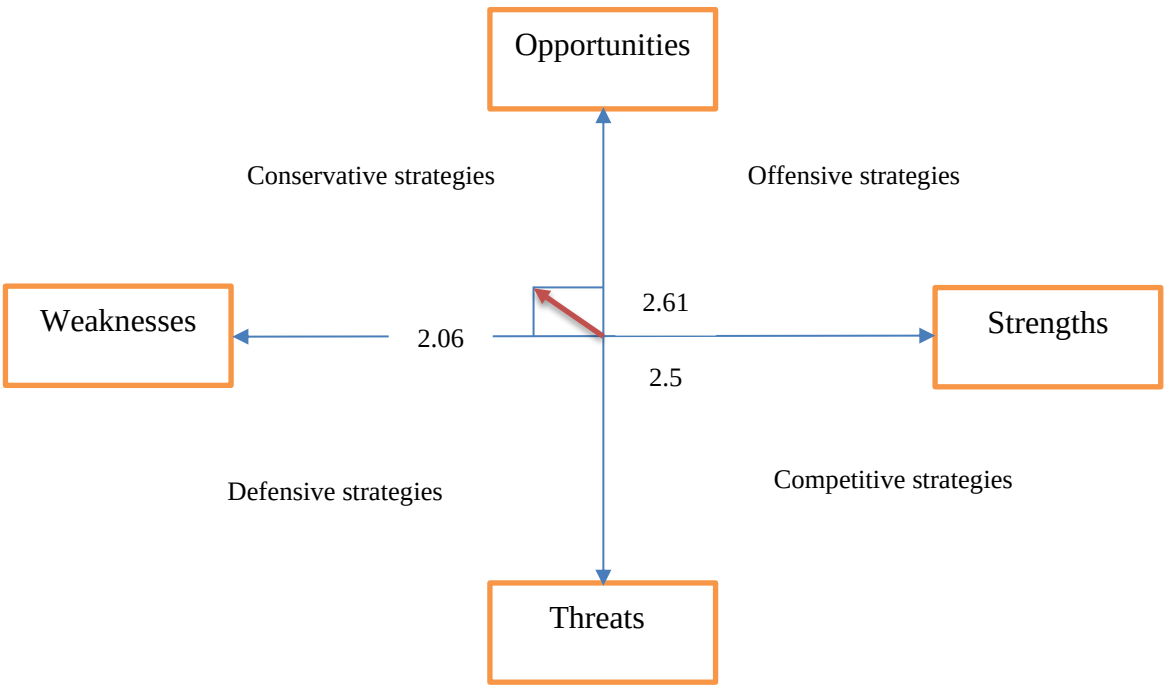


Fig.1- Strategic situation of the organization based on Quantitative Strategic Planning Matrix (QSPM)

As mentioned, based on the SWOT model, there are four strategies: SO, WO, WT and ST. The scores from assessing internal (2.02) and external (2.66) factors revealed that air quality management of the study district is in a conservative situation of internal and external matrix (Figure1).

Strategies were prioritized and then the best strategy was determined using QSPM. The QSPM was used to weigh the strategies derived from the SWOT matrix. To provide a quantitative strategic matrix, four factors (strengths, weaknesses, opportunities and threats) were extracted from the IFE and EFE matrices. The QSPM table shows the first row of strategies. Internal and external factors involved in success are evaluated to determine the score. Thus, a score of 1 to 4 was assigned to each factor. At this stage, the effect of other internal and external factors on the proposed strategy was predicted and the attractiveness score (AS) of each strategy was used in the range of 1 (minimum attractiveness) to 4 (attractiveness or feasibility) (Table 4). If a factor did not play an important role in the strategy selection process, it would not receive any scores. In the next step, the total attractiveness score (TAS) of each strategy was calculated. Given the length of the QSPM table for all four strategic situations, for example only the QSPM table of WO strategy is presented in Table 4 as the strategic situation specified in air quality management for the District 2 of Tehran Municipality.

Table 4: Quantitative Strategic Planning Matrix (QSPM) of air pollution planning in the study district

| Internal-external strategic factors | Weighted scores | Conservative Strategies (WO) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | WO1 | | WO2 | | WO3 | | WO4 | | WO5 | | WO6 | |
| | | AS | TAS | AS | TAS | AS | TAS | AS | TAS | AS | TAS | AS | TAS |
| No. Strengths | | | | | | | | | | | | | |
| 1 | 0.2 | 2 | 0.4 | 2 | 0.4 | 3 | 0.6 | 1 | 0.2 | 2 | 0.4 | 2 | 0.4 |
| 2 | 0.12 | 2 | 0.24 | 2 | 0.24 | 3 | 0.36 | 2 | 0.24 | 1 | 0.12 | 2 | 0.24 |
| 3 | 0.12 | 2 | 0.24 | 1 | 0.12 | 2 | 0.24 | 1 | 0.12 | 2 | 0.24 | 1 | 0.12 |
| 4 | 0.12 | 1 | 0.12 | 2 | 0.24 | 3 | 0.36 | 2 | 0.24 | 3 | 0.36 | 2 | 0.24 |
| 5 | 0.12 | 1 | 0.12 | 2 | 0.24 | 3 | 0.36 | 2 | 0.24 | 3 | 0.36 | 2 | 0.24 |
| 6 | 0.04 | 3 | 0.12 | 2 | 0.08 | 1 | 0.04 | 2 | 0.08 | 3 | 0.12 | 3 | 0.12 |
| 7 | 0.12 | 1 | 0.12 | 3 | 0.36 | 3 | 0.36 | 2 | 0.24 | 1 | 0.12 | 1 | 0.12 |
| 8 | 0.08 | 1 | 0.08 | 2 | 0.16 | 1 | 0.08 | 1 | 0.08 | 2 | 0.16 | 1 | 0.08 |
| 9 | 0.04 | 3 | 0.12 | 3 | 0.12 | 2 | 0.08 | 3 | 0.12 | 3 | 0.12 | 2 | 0.08 |
| 10 | 0.04 | 3 | 0.12 | 3 | 0.12 | 2 | 0.08 | 3 | 0.12 | 3 | 0.12 | 1 | 0.04 |
| N0. Weaknesses | | | | | | | | | | | | | |
| 1 | 0.12 | 1 | 0.12 | 1 | 0.12 | 1 | 0.12 | 3 | 0.36 | 2 | 0.24 | 1 | 0.12 |
| 2 | 0.14 | 1 | 0.14 | 3 | 0.42 | 2 | 0.28 | 1 | 0.14 | 2 | 0.28 | 1 | 0.14 |
| 3 | 0.08 | 1 | 0.08 | 1 | 0.08 | 2 | 0.16 | 1 | 0.08 | 1 | 0.08 | 1 | 0.08 |
| 4 | 0.04 | 2 | 0.08 | 2 | 0.08 | 3 | 0.12 | 2 | 0.08 | 3 | 0.12 | 1 | 0.04 |
| 5 | 0.03 | 1 | 0.03 | 2 | 0.06 | 2 | 0.06 | 1 | 0.03 | 2 | 0.06 | 2 | 0.06 |
| 6 | 0.05 | 1 | 0.05 | 2 | 0.1 | 2 | 0.1 | 1 | 0.05 | 3 | 0.15 | 1 | 0.05 |
| 7 | 0.06 | 1 | 0.06 | 2 | 0.12 | 2 | 0.12 | 1 | 0.06 | 3 | 0.18 | 1 | 0.06 |
| 8 | 0.08 | 1 | 0.08 | 2 | 0.16 | 2 | 0.16 | 3 | 0.24 | 3 | 0.24 | 2 | 0.16 |
| 9 | 0.08 | 1 | 0.08 | 3 | 0.24 | 2 | 0.16 | 3 | 0.24 | 3 | 0.24 | 1 | 0.08 |
| 10 | 0.16 | 1 | 0.16 | 3 | 0.48 | 2 | 0.32 | 3 | 0.48 | 3 | 0.48 | 1 | 0.16 |
| 11 | 0.03 | 1 | 0.03 | 3 | 0.09 | 2 | 0.06 | 3 | 0.09 | 3 | 0.09 | 2 | 0.06 |
| 12 | 0.1 | 1 | 0.1 | 2 | 0.2 | 2 | 0.2 | 1 | 0.1 | 3 | 0.3 | 2 | 0.2 |
| 13 | 0.05 | 1 | 0.05 | 1 | 0.05 | 1 | 0.05 | 1 | 0.05 | 1 | 0.05 | 1 | 0.05 |
| 14 | 0.04 | 1 | 0.04 | 1 | 0.04 | 3 | 0.12 | 1 | 0.04 | 1 | 0.04 | 1 | 0.04 |
| No. Opportunities | | | | | | | | | | | | | |
| 1 | 0.21 | 2 | 0.42 | 1 | 0.21 | 1 | 0.21 | 1 | 0.21 | 1 | 0.21 | 1 | 0.21 |
| 2 | 0.15 | 1 | 0.15 | 3 | 0.45 | 2 | 0.3 | 1 | 0.15 | 1 | 0.15 | 1 | 0.15 |
| 3 | 0.15 | 2 | 0.3 | 1 | 0.15 | 2 | 0.3 | 1 | 0.15 | 1 | 0.15 | 1 | 0.15 |
| 4 | 0.20 | 1 | 0.2 | 1 | 0.2 | 1 | 0.2 | 1 | 0.2 | 3 | 0.6 | 2 | 0.4 |
| 5 | 0.09 | 2 | 0.18 | 2 | 0.18 | 1 | 0.09 | 1 | 0.09 | 3 | 0.27 | 2 | 0.18 |
| 6 | 0.12 | 3 | 0.36 | 2 | 0.24 | 2 | 0.24 | 3 | 0.36 | 3 | 0.36 | 1 | 0.12 |
| 7 | 0.09 | 1 | 0.09 | 2 | 0.18 | 1 | 0.09 | 2 | 0.18 | 2 | 0.18 | 1 | 0.09 |
| 8 | 0.32 | 2 | 0.64 | 4 | 1.28 | 2 | 0.64 | 3 | 0.96 | 3 | 0.96 | 2 | 0.64 |
| 9 | 0.28 | 1 | 0.28 | 3 | 0.84 | 2 | 0.56 | 1 | 0.28 | 2 | 0.56 | 1 | 0.28 |
| 10 | 0.12 | 2 | 0.24 | 2 | 0.24 | 2 | 0.24 | 2 | 0.24 | 2 | 0.24 | 1 | 0.12 |
| No. Threats | | | | | | | | | | | | | |
| 1 | 0.10 | 1 | 0.1 | 2 | 0.2 | 1 | 0.1 | 2 | 0.2 | 1 | 0.1 | 1 | 0.1 |
| 2 | 0.12 | 1 | 0.12 | 2 | 0.24 | 1 | 0.12 | 2 | 0.24 | 2 | 0.24 | 1 | 0.12 |
| 3 | 0.06 | 1 | 0.06 | 2 | 0.12 | 2 | 0.12 | 1 | 0.06 | 3 | 0.18 | 1 | 0.06 |
| 4 | 0.08 | 1 | 0.08 | 2 | 0.16 | 2 | 0.16 | 1 | 0.08 | 3 | 0.24 | 1 | 0.08 |
| 5 | 0.08 | 3 | 0.24 | 2 | 0.16 | 3 | 0.24 | 1 | 0.08 | 1 | 0.08 | 1 | 0.08 |
| 6 | 0.05 | 3 | 0.15 | 3 | 0.15 | 2 | 0.1 | 2 | 0.1 | 1 | 0.05 | 1 | 0.05 |
| 7 | 0.08 | 3 | 0.24 | 4 | 0.32 | 1 | 0.08 | 3 | 0.24 | 2 | 0.16 | 3 | 0.24 |
| 8 | 0.10 | 3 | 0.3 | 3 | 0.3 | 2 | 0.2 | 1 | 0.1 | 1 | 0.1 | 1 | 0.1 |
| 9 | 0.07 | 2 | 0.14 | 2 | 0.14 | 1 | 0.07 | 2 | 0.14 | 1 | 0.07 | 1 | 0.07 |
| 10 | 0.14 | 1 | 0.14 | 2 | 0.28 | 1 | 0.14 | 4 | 0.56 | 1 | 0.14 | 2 | 0.28 |
| TAS | | | 7.21 | | 10.36 | | 8.79 | | 8.34 | | 9.71 | | 6.5 |

In this study, a total of 21 strategies have been developed (Table 4), 6 of which were placed in the QSPM for scoring due to their conservative situation (WO). The results of prioritizing the conservative strategies derived

from the SWOT model in the air quality management of the District 2 of Tehran Municipality through the QSPM method are presented in Table 5.

Table 5: Prioritization of air quality control strategies in District 2 of Tehran Municipality based on QSPM

| No. | WO strategies | Total attractiveness score | Priority |
|---|---|---|---|
| WO1 | Implementing scientific and practical projects to evaluate the components of the green city (such as e-city, reducing administrative bureaucracy, etc.) with a clean air approach | 7.21 | 5 |
| WO2 | Implementing a comprehensive energy management plan for vehicles and industries and plan for the use of clean energy | 10.36 | 1 |
| WO3 | Strict control and application of incentive and punishment policies in the production of domestic cars and compliance with standards in production fuels | 8.79 | 3 |
| WO4 | Estimating cost index-socioeconomic benefits of air pollution damage | 8.24 | 4 |
| WO5 | Attracting external funding for the development of public transportation technology, and applying alternative fuels (such as biodiesel) and fuel quality improvement technology | 9.71 | 2 |
| WO6 | Evaluating the extent of air pollution in areas without pollutant measuring stations using modeling and informing the authorities and the public about the spatial distribution of air pollutants | 6.50 | 6 |

## 4. Discussion

The present research presented the effective management strategies to reduce air pollution using SWOT matrix. Similarly, Rabieifar et al. (2013) applied the SWOT matrix to provide efficient solutions to solve environmental problems in Zanjan city (Iran), the results of which showed the efficiency of this matrix in providing macro strategies for urban management.

Concerning the IFE (Strengths and Weaknesses), as shown in Table 1, the final score of the IFE matrix was less than 2.5; therefore, the organization (District 2 of Tehran Municipality) has been generally weak in terms of internal factors and the management of internal factors affecting air pollutants by the municipality has been below average. Hence, the necessary strategies should be developed to enhance the strengths. In addition, in order to eliminate bottlenecks, upgrade and improve the management of weaknesses need to adopt the necessary policies.

As for the EFE matrix (Opportunities and Threats), it was found that the sum of the weighted scores of the EFE matrix was 2.61. The results of EFE show that the organization (municipality) is slightly higher than the average in terms of external factors, but not very strong according to the number obtained. Therefore, in order to manage the threats ahead, external threats must be turned into opportunities. Hence, macro-management, by formulating appropriate strategies, should act to control effective external factors (threats) and turn them into desirable opportunities and manage the opportunities ahead.

As shown in Figure1, the study organization is in a conservative situation in the current management path of reducing air pollution in this district, meaning that its weaknesses dominate its strengths, and its opportunities outweigh its threats. Therefore, conservative (WO) strategies are a priority for strategy formulation. In such cases, it is recommended that the organization (District 2 of Tehran Municipality) take advantage of the potential benefits of the opportunities to compensate for or eliminate existing weaknesses.

The results of prioritizing conservative strategies in air pollution quality management in the District 2 of Tehran Municipality (Table 5) showed that the "*WO5*" strategy with a total attractiveness score of 9.71 is in the second place and the "*WO3*" strategy with a total attractiveness score of 8.79 is in the third place according to the QSPM model. The fourth rank belongs to the "*WO4*" strategy with a total attractiveness score of 8.24, the fifth rank belongs to the "*WO1*" strategy with a total attractiveness score of 7.21 and the sixth rank belongs to the "*WO6*" strategy with a total attractiveness score of 6.5.

According to the analysis of QSPM results and comparing the total attractiveness score obtained for each strategy, the "*WO2*" strategy with a score of 10.36, among other conservative strategies, had a high score as the first priority.

Ataeifar et al. (2012) employed the SWOT matrix to evaluate the efficiency of the BRT system in Tehran on sustainability, and identified SWOT factors to provide strategies for using the public transportation system and its impact on reducing air pollution. Finally, they reported the effectiveness of the SWOT matrix in providing management strategies, in line with the results of the present study on the use of the SWOT matrix to achieve operational strategies to reduce air pollution in the District 2 of Tehran Municipality.

## 5. Conclusion

The present study employed the SWOT matrix to develop the air quality management strategies in the District 2 of Tehran Municipality, and the Quantitative Strategic Planning Matrix (QSPM) to prioritize the resulting strategies. To this end, the internal and external environmental variables affecting air pollution of the study district were first recognized and then evaluated by EFE and IFE matrices. Evaluation of strategies based on

scores from EFE and IFE matrices revealed that their values were equal to 2.06 and 2.61, respectively; as a result, the EFE and IFE matrices were in the conservative situation.

The results of the SWOT matrix identified a total of 21 strategies, six of which were in the conservative situation (WO). Based on the prioritization of WO2 strategy with the theme of "*Implementing a comprehensive energy management plan for vehicles and industries and plan for the use of clean energy*" with a total attractiveness score of 10.36 being the first priority is introduced as an effective strategic plan to reduce air pollution in the District 2 of Tehran Municipality. The results show the efficiency of SWOT matrix and QSPM method in formulating and prioritizing management strategies for organizations.

## 6. Compliance with Ethical Standards:

All authors promise that the work described has not been published before; and it is not under consideration for publication anywhere else.

This publication has been approved by all co-authors, if any, as well as by the responsible authorities – tacitly or explicitly – at the institute where the work has been carried out. The publisher will not be held legally responsible should there be any claims for compensation.

The authors declare no conflict of interest.

## Conflict of interest

The authors declare that they have no conflict of interest.

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