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Analysis of Key Factors Influencing Air Pollution of Metropolises in Developing Countries by Year 2025 (Case Study: Tehran Metropolis, Iran)

Análise dos Fatores-chave que Influenciam a Poluição do Ar nas Metrópoles em Países em Desenvolvimento em 2025 (Estudo de Caso: Metrópole de Teerã, Irã)

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Abstract

Air pollution is among the critical issues that many metropolises of the world, especially those in developing countries, are involved with. Hence, the present study seeks to identify the key factors affecting the expected air pollution in Tehran in the future (2025), to provide a suitable platform for solving the problem arising from it. The present study is a qualitative one in terms of application regarding the nature of the data and also a documental and a field study in terms of data collecting method. To analyze and identify the key factors, the analysis of interactions between factors is used. The main results indicate that five factors, namely, "management style", "environmental protection", "monitoring of pollutants", "timely planning" and "research and development" among the 21 identified are considered as the factors having a possible key role on Tehran air pollution by year 2025. In other words, these are factors capable of having a wide dominative influence on both the behavior of systems and other factors. The "satellite cities" are detected as highly important intermediate factors that can partially affect the dynamics of the system and the status of air pollution in Tehran. Important macro suggestions have been developed in the aimed time horizon based on the analysis done on these factors for solving this problem.
Keywords: air pollution; Management style; Overseeing the production of pollutants; developing countries

Resumo

A poluição do ar encontra-se entre as questões críticas de muitas metrópoles do mundo, especialmente aquelas de países em desenvolvimento. Neste estudo procura-se identificar os fatores-chave que afetam a expectativa de poluição do ar no futuro (2025) em Teerã, possibilitando uma plataforma para a solução dos problemas daí advindos. O presente estudo é uma análise qualitativa em termos de aplicação considerando a natureza dos dados e também a informação documental em campo. Para analisar e identificar os fatores-chave, foram utilizados as análises das interações entre os vários fatores. Os principais resultados indicam cinco fatores: "estilo de manejo", "proteção ambiental", "monitoramento de poluentes", "planejamento temporal" e "pesquisa e desenvolvimento, dentre 21 fatores, que são os como possíveis fatores-chave na poluição do ar em Teerã em torno de 2025. Em outras palavras, estes fatores serão responsáveis por uma ampla influência tanto no comportamento dos sistemas como sobre os demais fatores. As cidades satélites são identificadas como importantes fatores intermediários que podem parcialmente afetar a dinâmica do sistema e o status da poluição do ar em Teerã. Importantes macro sugestões foram desenvolvidas para num horizonte temporal baseado nesta análise resolver tais problemas.
Palavras-chave: poluição do ar; estilo de manejo; produção de poluentes; países em desenvolvimento

1 Introduction

Air quality in cities is the result of a complex interaction between natural and human conditions of environment. Air pollution in cities especially in developing countries is a serious environmental problem. Many cities suffer from serious problems of air pollution (Mayer, 1999). Air quality is being degraded due to increasing rate of urbanization in the world, and directly threatens health of a large part of the world population, natural and agricultural environment, surrounding high population areas and significantly leads to climate change at regional and global levels. This is a serious challenge in developing countries where rapid growth of metropolises is leading to unprecedented air pollutants. Greenhouse gas emissions in major urban and industrial areas influence air quality and climate change at regional, continental, and global scale (Decker et al., 2000).

Jonathan et al. (2000) show that in six metropolis of U.S. between 1987 and 1994 a significant amount of deaths is mainly a result of solid pollutants (PM10) and partly associated with the gaseous pollutants (ozone). In industrialized countries such as Germany, classic emissions are declining. This trend is evident for carbon monoxide (CO), sulfur dioxide (SO2), and total suspended particles (TSP), but not sensible for nitrogen oxides (NOx) and non-methane volatile organic compounds (NMVOC). In Germany, more than half of emissions of CO and NOx are caused by motor traffic and less than half the emissions of NMVOC are related to motor traffic. A survey conducted by Mage et al. (1996) shows that motor traffic is a major source of air pollution in big cities (Mayer, 1999). United Nations Population Fund in 2007, has predicted that the world population will increase from 3.3 billion in 2008 to five billion by 2030, resulting in increase of sensitive populations such as children and elderly groups. As a result, cities with serious air pollution problems need to find ways to control this problem and reduce the damages. Meanwhile, concern of metropolis in developing countries is more reserved, as the World Health Organization (WHO) in 2002 estimated that more than a million premature deaths per year throughout the world could be attributed to urban air pollution in developing countries (Yang et al., 2008). Molina et al. (2007) introduces Mexico as a city representing a variety of environmental problem experienced by metropolises around the world, emphasizing more on the problem of air pollution in developing metropolises.

Researches with the aim of establishing solutions for reducing air pollution have been conducted. For instance, after the air pollution crisis of Japan in 1960, various pollution controlling equipment and enforcement of stringent criteria have been used to reduce air pollution. Beside these measures, they could standardize pollution-aggravating products such as cars and finally, a series of measures led to reduction of air pollution in Japan (Nishimura, 1989). Innovative strategies such as planting trees in cities and green coverings have been used and recommended to reduce urban pollution (Nowak et al., 2006).

However, it is clear that air pollution has gradually and steadily gotten worse by industrial development and population density in urban areas and it has become an integral part of industrial life. Iran and particularly Tehran is no exception. Tehran is one of the most polluted places among the metropolises around the world. Tehran air pollution associated with death and other signs is emerging. Overall, 20 percent of all energy in country is consumed in Tehran. Pollutants such as SO2, NO2, HC, PM10 and CO are the main air emissions in Tehran. Currently, the concentration of pollutants exceeds the standard level which directly impacts the health of city residents (Karimzadegan et al., 2008) and the process of air pollution in Tehran (Table 1) shows a worrying and warning situation, so that the number of unhealthy days has increased from 40 days to 215 days per year between the years 2009 and 2011 (www.amar.sci.org.ir). Concentration of population and economic activities, as well as increase of use of vehicles contributed to increased air pollution in metropolises of developing countries including Tehran (Atash, 2007). The key questions regarding the described issue of the research invlove: what is the extent of air pollution factors in future Tehran (by year 2025)? Moreover, what are the main or most influential factors of air pollution in future Tehran (by year 2025)? Overall, this study provides a part of a planning context to resolve the major problem of metropolises in developing countries, particularly in Tehran. It is obvious that the operational phase of every

program is in the future and practically any program will be prepared for the future because the past is gone and now is being spent. For proper planning aimed at resolving the problem of air pollution in Tehran Metropolis, affecting factors of air pollution as well as polluters must be examined. The aim of this study is to focus on identifying the key factors for future air pollution in Tehran metropolis.

Year	2009	2010	2011
Clean	32	14	3
Healthy	291	247	144
Unhealthy	40	103	215
Very unhealthy	1	1	3
Hazardous	1	0	0

Table 1 Air pollution situations between the years 2009-2011, (www.amar.sci.org.ir).

2 Effective Factors air Pollution of Metropolises

A series of studies were done by Tea Lee et al. (1999) on sources of air pollution in cities of Seoul and Ulsan in South Korea. According to the research, traffic and temperature increase during the winter are the main sources of air pollution in Seoul. In addition, a major cause of air pollution in the city of Ulsan is due to industry (Tea Lee et al., 1999). In general, they have considered geographical aspects, transportation and industry as the major sources of air pollution. According to Mayer (1999) air pollution emissions caused by human activities that can be put into groups such as motorized traffic, industry, power plants, commerce and domestic fuel were classified (Mayer, 1999). It can be said that the most fundamental reason for air pollution in big cities is the rapid growth of urbanization (Tie & Cao, 2009) or in other words, rapid urbanization is a major environmental driving force affecting air quality on a local, regional and global scale (Molina & Molina, 2004). Due to the growing trend of urbanization in the world, the number of world's metropolises is expected to be added in the near future. Human activities such as the coordination of public and private transport, local air pollution and solid and liquid waste disposal lead to serious issues in the management of the metropolitan city (Lawrence et al., 2007). Growth of urbanization, especially in developing countries has been accelerated; Therefore, a higher level of pollution is expected in developing cities relative to developed ones. Generally, air pollution in big cities can be a result of many factors, including topography, industrial growth, transportation needs and population growth (Molina et al., 2007). The very important solution to solve the problem of air pollution in big cities alongside the recognition of present air pollution factors is the identification of air pollution in big cities of the future; a means to develop an appropriate program dealing rationally with the problem. In connection with possible scenarios for the future world, many researches have been done in the field of environment. In 2000 Peter Hall and Olrich Pfeiffer) have provided scenarios in relation to the future cities, time horizon of 2025 in different parts of the urban environment. According to three development driving force, they have assigned three different scenarios for cities on the time horizon of 2025 about different aspects such as urban environment: for the first case, the city is faced with the tremendous informal growth, for the second one, the city is facing a dynamic growth, and finally, a developed city dealing with weakness and aging (Hall & Pfeiffer, 2009). In general, the scenario of Hall and Pfeiffer perceived in different modes were based on the selected driving force in an urban environment. The threatening factors of future urban air pollution can be regarded as, using personal vehicles and their quality, old cars, industrial applications in poorer areas, poor supervision on the use of toxic gases, slow environmental supporting authorities, the increasing demand for use of personal vehicles, increased heat, increasing energy consumption per capita and low speed in technology utilization.

3 Research Methodology

The conducted study can be categorized as qualitative in terms of its practical objective and nature of date, while it may be considered to be documental and surveyable in terms of the method of data collection. As shown in Figure 1, to determine the various factors of study objective, brainstorming techniques or in other words, interviews with experts (university professors in the field of cities and Environment, and Related executives of Tehran) and relevant literature in this field have been used.

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Propulsion	Trend	The Trend scenario	Change of Trend	Scenarios for trend Change
The city facing tremendous informal growth	- Lack of knowledge - Lack of savings/ Investment and production, - Segregated needs of the city with tremendous growth dealing with all political activity	- Inefficient use of natural resources for the production of basic goods - Overuse of the natural environment - Slight improvement in water recycling - the development of informal settlements with little support for future generations	- Savings of scarce resources, - Low population growth	- medical and environmental goods Find greater priority - progress in combating air pollution through vehicles emitting less gas - improved control of old cars emissions - improved recycling of wastes
The city Dealing with dynamic growth	- Increasing productivity - Increasing standards - Facilities development creates new challenges for sustainability.	- Urbanization alongside with economic development will lead to more revenue and heavier traffic as well. - Space and demands of heating and cooling energy increase - Population growth - In the poorer areas industrial applications still produce toxic gases and wastes - Failed attempts to control emissions - delayed Political support environmental strategies - Regional Distribution in in metropolises through use of personal cars increases pollution and fuel consumption - Energy Crisis - Increasing signs of global warming - Increased flooding in low height areas	- Learning Cities - Using the international experience and knowledge - Day by day Cities get closer to sustainable development	- imaginary solutions for recycling programs, sustainable urban development, and transportation, - Urban Innovations - Reducing traffic - Development of public transport - Adequate supply of food and consumption goods - Better ecological education
Developed city facing with dwindling and aging	- More people with higher education - Democracy with appropriate bureaucracy - Strong taxation - Politically slow - Lack of appropriate adaptations to the needs of the elderly	- developed cities have the most per capita consumption of energy, water, space and materials - Eclipse of technical progress in reducing the use of resources	-aging is a Slow process -Cities avoid of excessive supportive policies - cities turn to Consensus- oriented policy - resort to the Necessary root treat	- making vigilante groups to use vehicles without emission - The formation of new traffic management system in large-scale - Strengthening infrastructure -New Energy Revolution or in other words transition from fossil fuels and nuclear energy, to solar energy / provides hydrogen era - building's Energy is altered, as in smart buildings

Table 2 Possible scenarios for the environmental status of the cities (Hall & Pfeiffer, 2009)

In qualitative analyzes, the quantity of experts is not high priority. So, in this research, we invite 20 experienced experts for collaborate. Key factors in the present analysis are based on the model and software of Micmac. Micmac Model and software is designed to perform complex calculations of crossover matrix. In this method, the software identifies the important component and variables of the desired fields and then imports them into a matrix, such as experts assess matrix of effects and the degree of association between these variables in relevant field. Variables in rows affect the variables in columns. Thus, variables of rows, indicate effectiveness and columns variables, indicate the degree of affectedness (Godet, 1994).

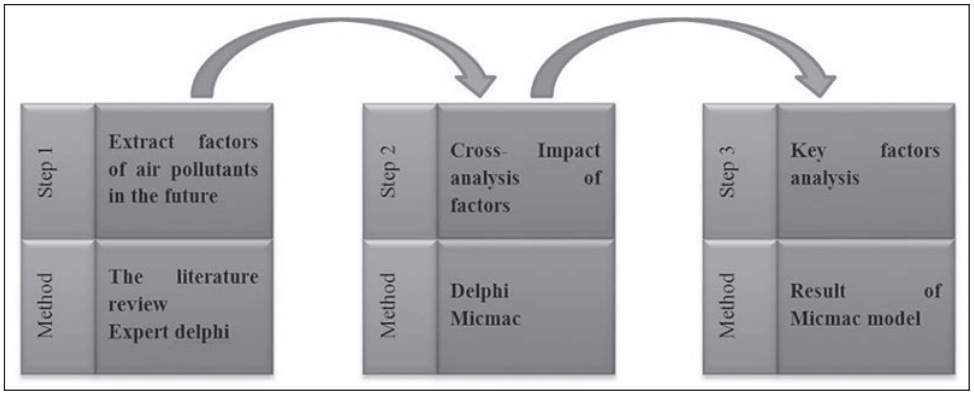

Figure 1 Research process

The amount of communication is measured with numbers between zero to three. "zero" as "no effect", "one" as "low effect", "two" as "moderate effect" and the number "three" as "high effect". Therefore, if n is the number of identified variables, an n × n matrix is obtained in which the impact on each other is specified (Asan & Asan, 2007). As a result, the total numbers in each row regularly indicate effectiveness of corresponding variable and the total numbers of each column show the respective affected variable. Then, all the variables and the environment in which they are contained can be displayed in a conceptual diagram or a coordinate axis (influence-dependence) display (Figure 2).

As shown in Figure 2, there are five categories of variables in this model. These variables are different due to their role in the dynamics of the system. The five categories include (Godet & Durance, 2008):

The input variables (1) are highly influential and independent. These variables tend to describe the system under study and condition the system's dynamic. When at all possible, these variables must be considered a priority when considering strategic plans of action.

The intermediate variables (2) are both highly influential and highly dependent. Thus, they are, by their nature, unstable. Any action taken on these variables will cascade throughout the rest of the system, profoundly affecting the system's dynamic.

The resultant variables (3) are not influential but very dependent. Their behavior therefore explains the impacts resulting from other variables, principally input and intermediate variables.

Excluded variables (4) are neither influential nor dependent. Therefore, they have little impact on the system under study. Often times these variables simply describe inertial or prevailing trends that change little over time. Other times, these variables are simply autonomous, and therefore have little impact on the system.

Excluding these variables, therefore, will have few consequences for our analysis. Finally, there are the clustered variables (5) which tend to congregate together. These variables are not sufficiently influential or dependent to be included among the previous classifications. We cannot draw any definitive conclusions about these variables and their impact on the system.

4 The Study Area

Tehran,Iran´s capital, is the largest city in the country; with the 22 municipal districts that define the official city boundaries (Sekhavatjuo et al., 2009), (Figure 3). According to different sources Tehran population changes from nearly 12 million during the days to 8 million during the nights. In fact Tehran's inhabitants are more than eight million (www.amar.sci.org.ir) and a population over four million people a day migrate to Tehran mainly from cities around it. Most metropolises are defined as the urban area where over 10 million people live in (Banister, 2011). This definition is arbitrary, as major urban centers often include people who are not located within a city's political boundaries. (Molina & Molina, 2004). According to the daily migration and other movements to Tehran the problems imposed on the city including air pollution, is regarded to be a result of a population

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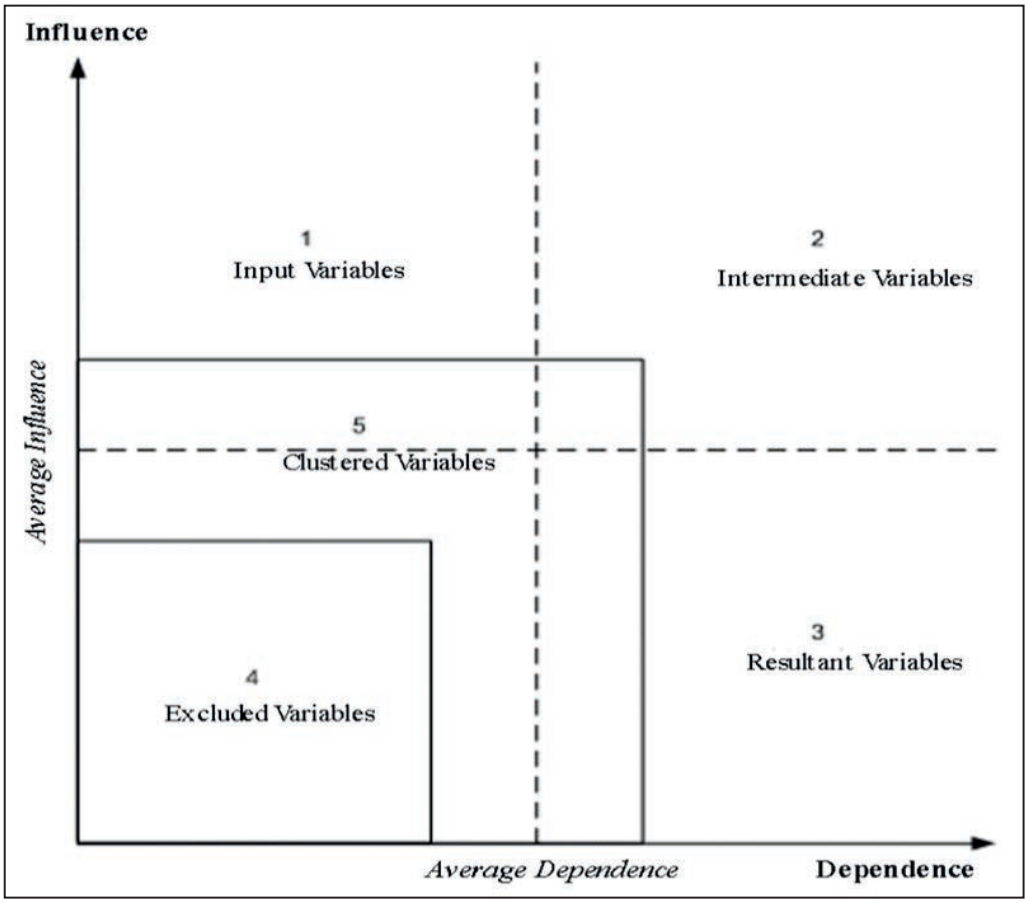

Figure 2 Different types of variables on the matrix with axes influence and dependence (Godet & Durance, 2011).

over twelve million. This is the largest concentration of population in Iran and the Middle East and is equal to population of Cairo and Istanbul. From Istanbul to Karachi, Tehran is only large urban complex of the area and is the only international metropolis that leaves behind the cities of Damascus, Baghdad, Baku, and Tashkent and makes the Iranian capital a central position among territories of India, Turks and Arabs (Habibi & Hourcade, 2005).

5 Results

In this study, the range of future air pollution in Tehran Metropolis (time horizon of 2025) is compiled through the use of documental study and expert opinions based on brainstorming techniques To do this, a questionnaire with open questions was prepared and provided for experts and at last, by categorizing the answers and combining them with the elements referred in documental studies as is in the theoretical fundamentals, factors, which are responsible for the pollution of Tehran in the future, have been detected as 21 elements (Table 3).

These factors are categorized in six aspects of transportation and traffic, humanity, geographical, urban planning, management and science and technology. In transportation and traffic aspects, factors such as transportation systems, old cars and quality of vehicles are considered. In the human dimension, the concentration of population, the demand for use of personal vehicles, informal settlements, migration and consumption patterns are derived as the causes of air pollution in Tehran Metropolis. Geographic and continental factors and the heat will be examined in terms of geography. In the aspect of urban planning respectively the six factors of, industrial applications, underserved areas, the focus of activities, timely planning, worn texture, the quality of communication networks and satellite cities have been identified. In the aspect of management, management style, overseeing the production of pollutants and environmental support

officials will be reviewed. Science and technology is another aspect of this study as the factors such as, taking advantage of technology and research and development have been extracted for it.

An important point in range of air pollution factors in Tehran is that the most common causes primarily returns to urban planning (six numbers) and in the next place to human factors (five numbers) (Table 4). It seems that planning appears to be an important phase in the area of future decision-making, and the fact that people and their behavior and activities are always important factors can be regarded. In the analysis of factors affecting air pollution in Tehran metropolis, MicMac model is used. The main idea dominating this model is a systematic thought. Hence, in this model, the range of factors are input rows and columns in the square matrix (21 x 21) and then the matrices are provided for the experts to evaluate the impact of each factor on others. The experts have evaluated factors respectively according to the impact of each factor in the row on each factor in the columns based on a variety from zero to three (zero = no effect, 1 = low effect, 2 = moderate effect and 3 = high effect). Indeed, by this evaluation, they indicate the effect of each element on the other factors through the next 10 years of Tehran.

Five categories based on the effect and influence in the MicMac output of the model is separable. The results obtained in the form (1) in the region (5) have been evaluated in four districts and are identified as factors that the system cannot definitely make a decision about. These are related to an analysis based on the influence and degree of similarity between such factors as well as the factors that exist in one of the four quadrant, therefore, the four general categories of factors in this study due to their efficacy and effectiveness are analyzed and classified. The first area (excluded variables) shows the factors that are little influenced and have less influence on others. In fact, this type of factors are the ones, which may be neglected based on the MicMac Mode.

These factors include, old cars (T2), the quality of personal vehicles (T3), climate and geographical structure (G1), heat (G2), industrial applications in deprived areas (U1) and use of technology (S1) (Figure 4).

The second area (Resultant variables) shows factors that are much influenced and have little influence on others. With respect to the evaluation that experts have done, eight factors; transportation system (T1), the use of personal vehicles (H2), an informal settlement (H3), consumption patterns (H4), immigration (H5), focus of activity (U2), worn tissue (U4), and quality of communication networks (U5), are the factors that influence them more than the other factors influencing their overall air pollution in Tehran in 2025 (Figure 5). In fact, these factors contribute to

Aspects	NO.	CO	Factors	Aspects	NO.	CO	Factors
Transportation and traffic	1	T1	Transportation system	**Urban planning**	11	U1	Industrial applications in deprived areas
	2	T2	Old cars		12	U2	Focus of activity
	3	T3	The quality of personal vehicles		13	U3	Timely Planning
Humanity	4	H1	Concentration of population		14	U4	Worn tissue
	5	H2	The use of personal vehicles		15	U5	Quality of communication networks
	6	H3	An informal settlement		16	U6	Satellite cities
	7	H4	Consumption patterns	**Management**	17	M1	management style
	8	H5	Immigration		18	M2	Overseeing the production of pollutants
Geographical	9	G1	climate and geographical structure		19	M3	Environmental support officials
	10	G2	heat	**Science and technology**	20	S1	Use of technology
					21	S2	` R & D

Table 3 Domain of Tehrans air pollution Factors in the future (2025)

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Aspects	Science and Technology	Management	Urban Planning	Geographical	Humanity	Transportation and Traffic	Total
Frequency of factors	2	3	6	2	5	3	21

Table 4 Frequency of Tehran's air pollution factors from different aspects in future

Figure 4
Excluded
variables

air pollution in Tehran, but its role is dependent on factors that affect them.

In the third area (Intermediate variables) are the variables that represent the high influence and impact on others. They are also called intermediate factors. These factors include the concentration of population (H1) and satellite cities (U6) (Figure 6). These variables are very unstable according to their nature (being influenced by other factors and influence a lot on other factors). Any future change and evolution of these variables can actually affect the dynamics of the system. In other words, the status of these factors and their influence on air pollution in metropolitan Tehran in 2025, also depend on many other factors, and meanwhile is impressive in its own kind.

Figure 5
Resultant
variables

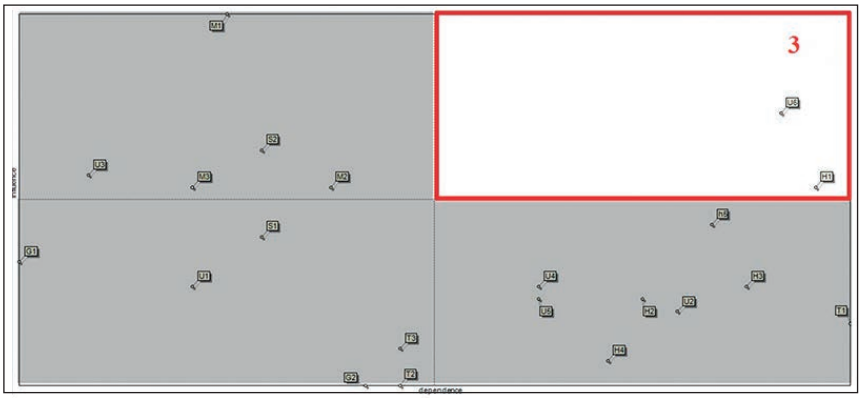

Figure 6
Intermediate
variables

However, the fourth area (Input variables), represents the most valuable or in other interpretation, the key factors affecting air pollution in Tehran Metropolis in 2025. In fact, the level of influence of these factors is higher. In other words, the dynamics of the system is a highly dependent variable, and the main factors determining the system include management style (M1), overseeing the production of pollutants (M2), Environmental support officials (M3), Timely Planning (U3) and R & D (S2) (Figure 7). These factors reveal strategic priorities of Tehran metropolis air pollution crisis on the time horizon of 2025, and defines in the next 11 years what would be involved in the first place focus on the macro factors.

Table (5), has revealed the net effect of each factor and each dimension. The amount of influence factors is explained. However, the net effect of each dimension is important. Table 5 shows the management of science and technology has the highest degree of influence on Tehran's air pollution crisis by year 2025. In other words, compared to other dimensions, most strategic and vital aspects of Tehran's air pollution crisis are these two dimensions. Level of importance, the geographical dimension, urban planning, transportation and traffic, are the next dimensions. If these categories which are based on the frequency are compared with the ones which are present in the categories in Table 4, it can be observed that by analyzing the effects of transvers factors, the status and human dimensions of urban planning that had a higher rating, are now in significantly lower positions, and have been replaced by the dimensional management science and technology. In fact, the quantity of each factor in each dimension is not a measure of the degree of importance and determines quality and impact of each factor or true value of factors and dimensions.

Figure 7
Input
variables

Aspects	CO	The amount of influence	The amount of Dependence	The net influence of each factor	The net influence of each dimension	Aspects	CO	The amount of influence	The amount of Dependence	The net influence of each factor	The net influence of each dimension
Transportation and Traffic	T1	7	24	-17	-32	Urban Planning	U1	10	5	+5	+2
	T2	2	11	-9			U2	8	19	-11	
	T3	5	11	-6			U3	19	2	+17	
Humanity	H1	18	23	-5	-44		U4	10	15	-5	
	H2	9	18	-9			U5	9	15	-6	
	H3	10	21	-11			U6	24	22	+2	
	H4	4	17	-13		Management	M1	32	6	+26	+48
	H5	15	20	-5			M2	18	9	+9	
Geographical	G1	12	0	+12	+4		M3	18	5	+13	
	G2	2	10	-8		Science and Technology	S1	14	7	+7	+21
							S2	21	7	+14	

Table 5 The amount of influence of each dimension

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Because the system analyzed in terms of the major areas are in Resultant variables, Input variables and Excluded variables, are among the systems that are relatively stable (Figure 8). Sustainable systems are expected to behave in a very large extent influenced by the key elements of the system. However, in the unstable system, the factors are almost in four areas and tend toward based Center. In this case, the system behavior cannot be regulated solely by key factors. Of the reasons of instability is the existence of a significant amount of factors, which has a high level of effectiveness and affectedness (intermediate variables). In the system studied, these factors were much less present than the key factors.

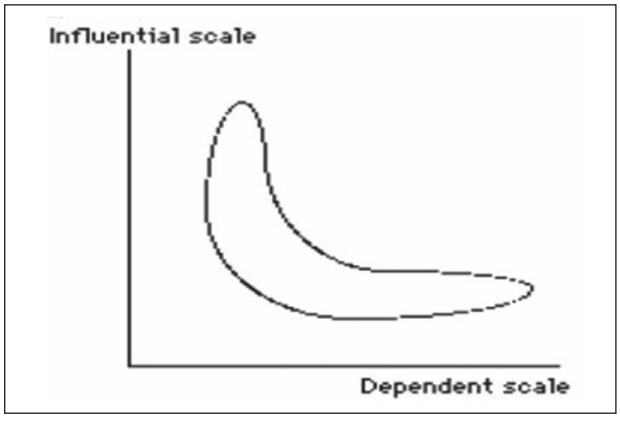

Figure 8 How the system stability (Godet, 1994).

6 Discussion

The results show that the most effective aspect is management in air pollution of Tehran in 2025. On the other hand, human features are of the most affected aspects, which is due to their centralized structure, meaning that country and people less govern cities and their role in managing is not important, and it is the governors' decisions, which determine the people's behavior. In other words, the decisions made by the authorities for Tehran metropolis are mainly centralized and non-cooperative and this has resulted in low level of effectiveness and affectedness of human factors in the pollution of Tehran metropolis. Somehow, management elements, including "management style", "environmental protection authorities" and "monitoring pollutants" are all factors that have been identified as the key ones. Hence, it seems necessary to have a correct attitude and approach to sustainable positive effects of these factors in order to reduce air pollution in Tehran metropolis on the time horizon of 2025. Regarding this issue, Drucker (2002), believes that what matters is to get free from the past and not to be undertaken to anything; he thinks that building future is impossible unless we forget the past because preserving the past is time consuming and difficult. Even if we want to, we would face new problems. The importance of innovation is obvious here. If the managers spend time on preserving the past, they cannot innovate for future (Drucker, 2002). It seems that the approach, which is dominant on managing, should be aware of future and be able to predict it. It is through inventions and innovations that facing new difficulties minimizes. At any rate, it seems that city managers can hope for improvement of air condition in Tehran city in the future years by correct and appropriate management and support. Another consequence of the different factors that is shown in the urban planning, which is "timely planning", is considered as one of the key influential factors among all factors that have been identified in various dimensions. Atash (2007) studies in the field of Tehran's air pollution indicate that many of the strategies in Tehran's 10-year comprehensive plan in the field of controlling air pollution, which starts from the year 2000, have been done with delay. In fact, there is a large gap between the plan and its functionality. Faludi (1970) believes that planning is human's tendency toward the future, problem solving in the future, providence, and optimism. In fact, it shows the significance of planning and having a purpose before a crisis. In other words, rather than engineering and project-oriented measures to solve transient problems, with appropriate monitoring of programs in the future we can plan before the crisis in order to reduce air pollution in Tehran metropolis. In relation to this, Mage et al. (1996), assert that two phases of the program should be focused on short and long term. They suggest promoting the use of public transport, improving fuel quality, increase vehicle fuel quality monitoring as a short-term offer. Preventive applications also included in the development of new towns, and the use of clean technologies as long-term measures were proposed.Another fundamental factor affecting the overall air pollution in Tehran by year 2025 is identified as "Research and Development".

Research should be considered as bleed flowing in vessels of a modern society, because a modern society, owes its modernity to fundamental research and applying them (Zali, 2009). In general, the importance and status of research and development are undeniable axioms. Identifying problems, providing practical solutions, all in the organization and funding, are appropriate subjects in this section. In a world where creativity and innovation are essential to development, dedication to research and development seems to be the engine of innovation and creativity. Cleaner air in Tehran in 2025, however, needs the fundamental research effort in this area.

One of the important not key factors is "satellite cities". This factor is an important intermediate factor. Satellite cities are important because they can actually affect the system dynamics because of their high level of effectiveness and being affected. Creating new urban centers mainly takes place with the aim of reducing the concentration of population (Stone, 2008). Satellite towns made around Tehran in the past two decades are virtually dependent cities and residences. In fact, the populations of these towns migrate to Tehran daily. Thus, due to extra population flowing from these towns to Tehran daily, not only a reduction will not happen in Tehran's population, but also leads to different disorders that exacerbate the air pollution. The main reason of this is an increase in traffic which result in more consumption of fossil fuels.

7 Conclusions

The aim and focus on of this study was identifying the key factors future air pollution in Tehran Metropolis. Firstly, a range of factors affecting air pollution by year 2025, through brainstorming techniques and combining them with the theoretical factors that have been identified through the study of documents. The range of air pollution was identified in six dimensions and 21 factors (Transport and traffic, human geography, urban planning, management, science and technology). Based on the logic system through analyzing the effect of interactions with MicMac software, results are marked in the following form:

By considering the stability of the system, "management style", "Overseeing the production of pollutants", "Environmental support officials," "Timely Planning" and "Research and Development" were identified as expected factors having a key role in Tehran air pollution by year 2025. In other words, these are factors that strongly influence the behavior of large control systems, as well as other factors. In addition, satellite cities are considered to be an intermediate factor, to the level of and important but not a key factor, which can somewhat affect the dynamics of the system.

Overall, while considering the results and discussions, as well as five key factors (Management style, Overseeing the production of pollutants, Environmental support officials, Timely Planning, research and development) and one important factor of "satellite cities", this study offers the following key suggestions in order to constructively deal with the aim of reducing air pollution in Tehran metropolis in 2025.

Establishment of strategic vision and central applications in practice of management of Tehran metropolis - Establishment of democratic and participatory vision in practice of management of Tehran metropolis.

Creating appropriate structures using the integrated urban management.

Fundamental and appropriate environmental protection of the different sectors, with the aim of reducing the air pollution in Tehran in long-term.

Strict and continuous monitoring of harmful emission.

Efficient and forethoughtful planning with a focus on sustainable solutions rather than the solutions, which are sectional and project-based.

Timely implementation of enforcement measures aimed at reducing the gap between application programs and practices.

Establishment of a scientific solution for air pollution crisis in Tehran, professional development and increasing moral and material support of R & D centers and the efficient and purposeful use of them.

Planning and creating sustainable employment in the satellite cities with the aim of making them independent.

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